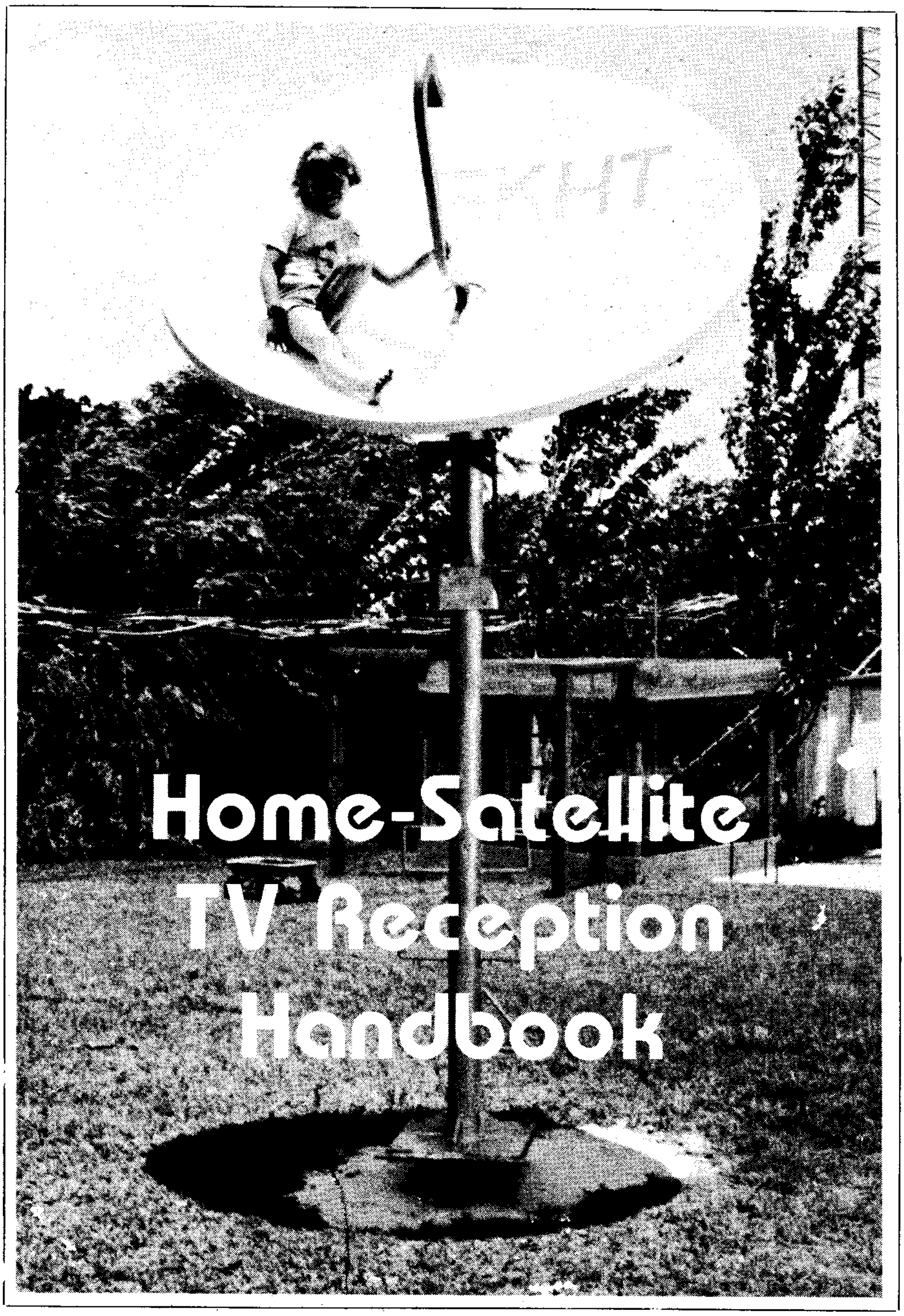
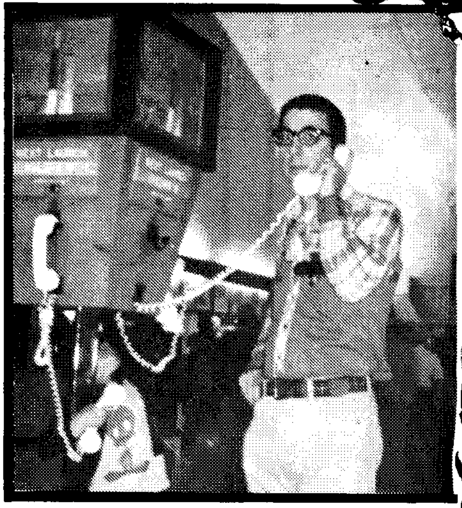
$7.50 per copy



Home-Satellite TV Reception Handbook

PUBLISHED BY: Satellite TV Technology
P. O. Box G
Arcadia, OK 73007
(405-396-2574)

Satellite TV Handbook



COOP CHECKING ON FLIGHT INFORMATION - at The 'Cape' in Florida where NASA maintains up to date information on the status of all existing and pending geostationary flights.

HOME SATELLITE
TV RECEPTION HANDBOOK
by
Bob Cooper, Jr.

Revision III, Copyright 1979
Satellite Television Technology
P. O. Box 2476
Napa, Ca. 94558

WELCOME . . .

. . .to the very fast changing world of satellite television communications! If this is your first in-depth exposure to the world of satellite television, you have timed your 'entry' at a very opportune point in history. You are learning what this exciting new communications world is all about just as low-cost, private (as in 'back yard') satellite television reception systems are becoming a reality. Approximately one year ago, in the fall of 1978, when I wrote a feature article for the American and Canadian versions of **TV GUIDE** only a handful of privately-owned satellite TV reception systems, or terminals as they are known, were in operation. And most of these had been purchased by well to do folks with upwards of $25,000 to spend for the system. Shortly after **TV GUIDE** article appeared in print (and we began hearing from thousands of people who wanted to have their own terminals), the **Cronkite CBS Evening News** visited my pioneering home terminal and I talked with the reporter about the probability that lower cost terminals would come along soon. As close as I was (and am) to this new television 'system' my own estimate of how far down the price for equipment would drop, and how soon, missed the mark widely. Today, as you well see here, a person with some technical smarts can assemble his own station for between $500 and $1000 and some people have done it for less than $500! The television trade press is already quoting 'knowledgeble sources at **Radio Shack**' as "expecting to see home satellite terminals available on the market by **the fall of 1981** for around $1,000". And that's with a profit built in for the seller!

In the pages of this Handbook we cover the **present state** of the satellite TV 'art', and explain what the basic rules of the game are. If you digest the material in this Handbook, follow up on the sources for additional information listed here, and stay with the topic through the next year or two I can promise you more television excitement than you can possibly absorb. A year ago I was fortunate to have 10 channels of high quality satellite TV into my home. Today that number is beyond 50 channels and growing every month.

Because this whole 'industry' is changing so rapidly we are constantly revising our information data base and our reference sources for additional information. The first edition of this Handbook came out in November of 1978. Here in early July of 1979 we are already into our third sustantial revision and the fourth printing. This publication is one of a whole series of printed and videotaped materials produced by Satellite Television Technology. If you live in a town with cable television, you can ask the cable company to provide your cable servie with the (no charge) **Satellite Program Network** (seen on RCA SATCOM F1, transponder 21) where, every Thursday at 12 noon eastern (etc.) we produce our 60 minute 'SATELLITE MAGAZINE' program. In that way you can tune in on the fast changing world of satellite TV, via your local cable service, before you install your own satellite TV terminal. What better way to stay current in this fast changing world than to use the medium itself to communicate! See you 'on the tube'.

Bob Cooper, Jr.
Satellite Television Technology

HOME SATELLITE TV RECEPTION HANDBOOK

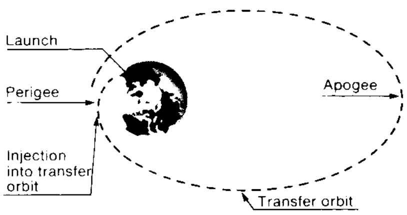
BY

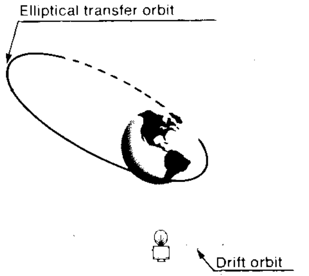
Bob Cooper, Jr.

WHERE AND WHEN IT ALL BEGAN

The first use of a manmade orbiting satellite to relay television pictures occured in 1962 with an early generation satellite called **Telestar**. This early satellite, like many others lifted above the earth by rocket and placed into orbit in the 60's was, in terms of today's sophisticated satellites, a 'low orbit' instrument. Lacking the rocket power to lift a weighty device such as a communications relay station (which is what a television satellite really is and does) into a 'high orbit', and the control systems to keep it there, the early satellites went around (and around) the earth fairly close to the earth's surface; often no more than 100 to 150 miles above the surface of the earth at their closest (perigee) point. Because they were close to the earth, they had to keep moving, at some speed great enough to prevent them from 'stalling out' and being dragged back to earth by gravity. To transmit an electronic message (radio, television, etc.) to such a satellite relay station, and to receive a message back from such a satellite required that a ground based earth station have an antenna that was capable of pointing at the orbiting satellite as it passed overhead. With the satellite **constantly moving**, the ground station antenna had to move as well to track or follow the satellite. And because the satellite's elevation was quite low, the ground station could 'see' the satellite only for a small portion of the orbit around (and around) the earth.

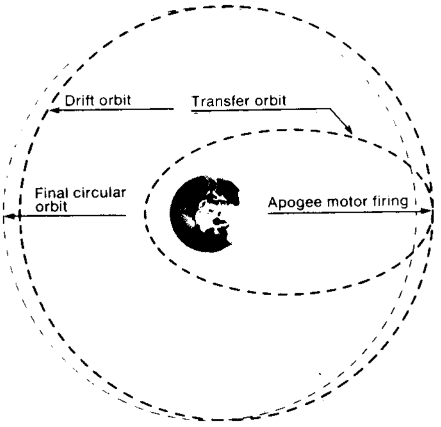
In 1963 these primitive early satellites gave way to a new concept pioneered by the Hughes Aircraft Company which was named **Syncom**. The Syncom experiment placed a satellite approximately 22,300 miles above the earth's equator and pointed the satellite's forward direction of movement along a line identical to the earth's rotation on its axis. By carefully controlling (from the ground through radio command systems) the forward speed of the satellite and matching that speed to the earth's rotation on its axis, the satellite achieved something known as **geostationary orbit**. That is, the satellite moved ahead at precisely the **same speed** as the earth rotates on the axis and this means that for a transmitting station or receiving station located on earth, the satellite always seems to 'hover' in the same precise spot in the sky.



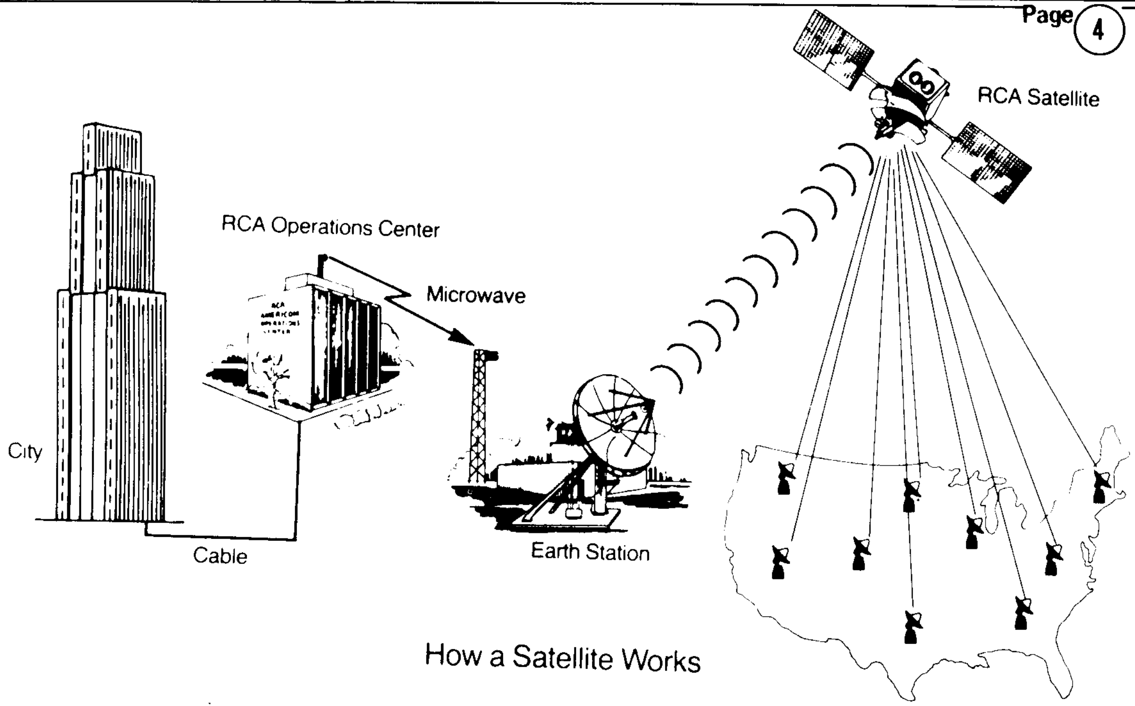


This tricky manuever didn't just happen; it required very careful rocketry system design to place the stellite payload into precisely the right orbit above the earth at just the right elevation (or altitude) and pointed in the correct direction, and, moving at the precise forward speed to keep the satellite and the earth in synchonization. An English space-visionary named Arthur C. Clarke had first postulated such a system, down to the details of the launch and orbit trajectory way back in 1945. But it took nearly 18 years after Clarke's vision to assemble the technology to make the system work.

The satellite itself is a complex system that must create its own power, fix itself when something goes wrong, adjust itself when the gravitational forces of the moon and earth and sun change (as they do constantly), or when 'solar winds' from our sun increase and press downward on the craft. Modern satellites such as those we are dealing with for our television service weight between 1,800 and 4,000 pounds. They contain a series of radio/television receivers which pick up the transmissions sent to them from earth (this is called the 'uplink' in the trade), a series of frequency converters that change the uplink transmissions to a new series of frequencies for the trip back to earth (and this is called the 'downlink' in the trade), a set of transmitters (called transponders) which boost the power of the downlink signals heading back to earth and a set of complex transmitting and receiving antennas. Getting this much electronics into a relatively small package (typically 4 to 6 feet on a side and either square or rectangular) is enough of a trick; but there is more. Also on board are banks of 'solar power cells' which must stay pointed towards our sun to receive the sun's rays which are converted into electrical power to operate the electronics on board, plus batteries to store that power for the occasional periods when the earth gets between the sun and the satellite causing a miniature eclipse for several hours. Then because the satellite wants to 'drift' away from its assigned orbit spot, a series of (typically 12) miniature rocket thrusters are built into the satellite's surface and on command they are fired to gently nudge the satellite back into its proper orbit position. **There is more yet in this box!** While you may be watching one or twenty four different channels of television through the satellite, at any hour of the day or night, someplace a 'flight controller' sitting in a large control center is actually 'flying the satellite'; all day and all night, 365 days a year. The satellite sends a constant 'stream' of electronic messages back to earth to the controller and a series of computers constantly analyze everything happening 'on board' from the condition of the rocket thrusters to the temperature of the satellite's surface skin and the operating condition of the satellite receivers and transmitters. When something goes beyond the established limits, the controller transmits commands from earth to the satellite and this allows the flight controller to make minor or major 'surgical changes' in the operation of the satellite from nearly 25,000 miles away.



The technology of the satellites is a fascinating subject and for those who wish to learn more about it, we suggest you check the listing of videotapes available in the last pages of this Handbook. One includes a detailed tour of an RCA control station that fully explains, on color videotape, just how this whole system operates.



How a Satellite Works

The satellite is essentially a (microwave frequency range) 'relay station'. Other than a few on-board system operational signals, the satellite creates no real transmissions of its own; it simply relays (or repeats) what it receives from earth. In a sense, it is an opaque device that receives uplink signals, converts them to a downlink frequency band, and then re-transmits them back to earth exactly as the signals are received. Because of the considerable distances involved (from 22,300 to 26,000 miles up **and** back) there is a slight delay in time as the signal(s) travel to the satellite and back. It amounts to 1/5th second or so in real time, so if you hear an announcer say it is exactly 6 PM in Atlanta via satellite, by the time you hear him say that it is really 6 PM plus 1/5th of a second in Atlanta. This is by way of illustrating just how high above the earth the satellite 'rests'.

It is this extraordinary altitude which makes the satellite such a valuable device. A brief explanation of why this is so follows. **Some** radio waves travel along the ground and follow the curvature of the earth. **Other** radio waves bounce around the earth via a reflective medium known as the ionosphere. **Still other** radio waves (or television) travel in a straight line; when they leave the transmitting antenna they can be received only as far as a person can 'see' if he is sitting atop the transmitting antenna. Then these 'straight-flight' waves continue their travels on through the earth's atmosphere, going higher and higher above the earth as they travel further and further from the transmitting antenna. Eventually they leave the atmosphere, and the ionosphere behind and they are in 'free space'.

Regular television stations locate their transmitting antennas on top of tall buildings, tall towers or mountains to give them greater reach. They want their transmitting antennas to 'see' as far as possible before the 'straight-flight' waves leave

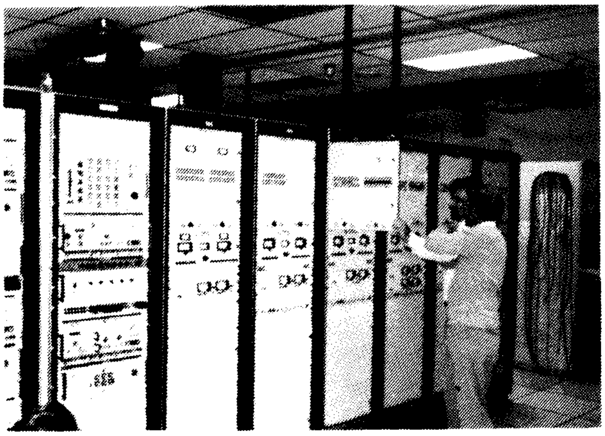
UPLINK ANTENNA - this huge (nearly 50 foot diameter) transmitting (and receiving) antenna at RCA Vernon Valley (N.J.) is the uplink transmission system that carries the television programs to the SATCOM satellite.

WESTAR CONTROL - this control panel is where the Western Union 'flight controller' sits to monitor the operation of WESTAR I, II (and III) twenty four hours per day. Status of more than 100 operating points on satellites is displayed on CRT displays in front of operator.

the earth's surface and head into free space.

With that background, imagine how far a television station could transmit if the television station's antenna was not 500 or 1,000 **feet** high... but 22,300 **miles** high! That's the basic secret of the satellite; it is so high above the earth that it can 'see' a very large portion of earth. In fact, one satellite is **capable of** reach (or 'covering') 40% of the earth's surface at a time. Some satellite systems do attempt to reach that much of earth simultaneously although the satellites of interest to us in North America do not. There are more than 30 of these 'geostationary' satellites now in operation, spaced around the earth above the equator. The large four color wallchart, which you may have received with this Handbook, illustrates where these satellites are located. Those that cover large areas belong to the so-called **'Intelsat'** family; these are satellites operated for international communications relay and you will notice on the wallchart that three separate **clusters** of these Intelsat satellites group around the earth. Between the three 'clusters' virtually all of the earth's surface is reached with television, radio and data communications. Reception of the Intelsat satellites, which includes television programming originating in Europe, Africa, the Middle East, South America and the Pacific **is possible** for satellite viewers in most of North America but this is a separate subject unto itself and will not be detailed here. A reference given in the section at the end of this Handbook can provide you with more information in this area if international reception intrigues you.

The satellites of interest to most North American users of this Handbook operate in a different manner. Although it is possible to 'see' or reach 40% of the earth's surface from a single satellite location above the equator, not all satellites want to reach such a wide area. Those that do **not** are called **'domestic satellites'** because they have been designed primarily to serve receivers and transmitters located within the confines of one national geographic area; such as the United States, or, Canada. By international agreement, satellites are 'licensed' to serve either big chunks of earth (as in the Intelsat family) or they are licensed by a single country to serve (in theory) just that one nation. A domestic satellite is very similar to an international satellite (i.e. they operate with similar equipment) **except that** international satellites utilize on-satellite transmitting and receiving antennas which 'look at' **all** of the earth's surface they can 'see' from their 22,300 mile altitude while domestic satellites employ specially designed 'directional' transmitting and receiving antennas that 'see' **only that portion of the world below** which includes the nation they wish to serve. This says that the Canadian 'ANIK' series satellites are licensed to serve Canadian viewers, that the many U.S. series domestic satellites (SATCOM, WESTAR, COMSTAR) are in turn licensed to serve the 50 individual states and the U.S. possessions such as Peurto Rico.



UPLINK TRANSMITTERS - one bay (of several) of the Western Union uplink site at Vernon Valley (N.J.) where the 6 GHz uplink transmitters generate the power to make the uplink signal arrive at the satellite in good form.

There are advantages and dis-advantages to this domestic approach. The advantage is that by 'directing' all of the satellite transmitter power towards a segment of the earth (such as Canada) rather than spraying it over 40% of the earth's surface, the **strength** of the satellite signals, as received on the ground, **is increased**. The analogy here is a quart container of water. If you pour it over a piece of ground that measures 1 foot by 1 foot the water will be of a certain depth. If you take the same quart of water and pour it over a piece of ground 10 feet by 10 feet, the water will have to 'spread' over a larger area and it will be much 'thinner'. The 'depth' of the water in our example is analogous to the 'strength' of the satellite's signals. In effect, the domestic satellites **concentrate** their available transmitting power into a relatively smaller portion of the earth's surface such that their signals are stronger in the area served than signals from the Intelsat satellites. This means you can receive the signals from domestic satellites with far less sophisticated equipment than is required for Intelsat satellites.

The disadvantage to this approach should be obvious; if you live in Bermuda, for example, or Venezuela you can reasonably expect that the signal strength into your area from the U.S. (or Canadian) 'domestic' satellites will be quite low. As a practical matter satellite signals do not 'stop' at national boundaries; the Canadian ANIK satellites are received with high quality well down past the mid-point line of the United States (roughly north of a line from San Francisco to Norfolk) even with relatively simple equipment and because the U.S. domestic satellites must reach as far northwest at Alaska, southeast as Puerto Rico and the Virgin Islands, northeast as the tip of Maine and southwest as far as Hawaii... many non-U.S. pieces of geography are also reached in the process.

Without spending time explaining 'why', there are several key concepts you should understand about the unique abilities of a satellite:

1) **The satellite 'sees' you**. This means it is up in the sky, south or southwest of your location. There is nothing between you and this 2,000 pound 'box' but a few miles of lower atmosphere and then space.

2) **Satellite signals are very stable**. If you live in an area where your (normal) terrestrial television travels some distance (50 miles or more) before it reaches your home, you are familiar with variations in TV reception quality. On some days the reception is 'picture perfect', on other days it is marred by interference or 'noise'. This happens because of changes in the earth's atmosphere, or weather patterns. A 'terrestrial' television signal must travel through tens of miles of atmosphere to reach your home. A satellite signal travels at most through just a couple of miles of atmosphere (with weather) and it is almost totally ignorant of these weather changes. Changes in received signal strength due to weather or the atmosphere are virtually unmeasureable, even with highly sophisticated equipment.

3) **Satellite reception quality is superb**! Your local television station, if it is affiliated with one of the TV networks, receives its programs via a series of terrestrial microwave relay stations. A television station in Texas, for example, receives its network signal after the *network signal* has been received **and relayed** by perhaps 50 different 'repeater stations'. The satellite is just like these terrestrial microwave repeater stations; except rather than requiring 50 (or some high number) of 'repeaters' along the way to your home, only **one** repeater (**the satellite**) is required. You are, literally, only one 'relay station' (the satellite) away from the network studios with the satellite. Because every repeater station degrades the signal quality slightly, satellite reception is the closest thing most of us will ever see to 'network studio perfect' television.

4) **Satellites are multiple channel systems**. Modern satellites operate with either 12 or 24 separate channels (or 'transponders' as they are called). All satellites of interest to us operate in the same frequency band yet they do not cause interference to other satellites simply because of the directional characteristics of our receiving antennas. We'll discuss this shortly. When you point your satellite receiving antenna at one particular satellite, you have access to all of the channels on that satellite. By moving (as in rotating) your receiving antenna to another satellite's location in the sky, you then have access to all of the channels on the new satellite. The number of channels you can receive is a function of the number of satellites you can receive times the number of operating channels available.

KTBN FONTANA - is one of three twenty four hour per day religious channels available on the satellite.

5) **Satellites operate full time**. Many of the satellite TV channel services operate twenty four hours per day. Others may operate say 20 hours per day but they operate according to their **local** time zones. This means that if you are located in the eastern time zone, for example, as satellite channels that 'originate'

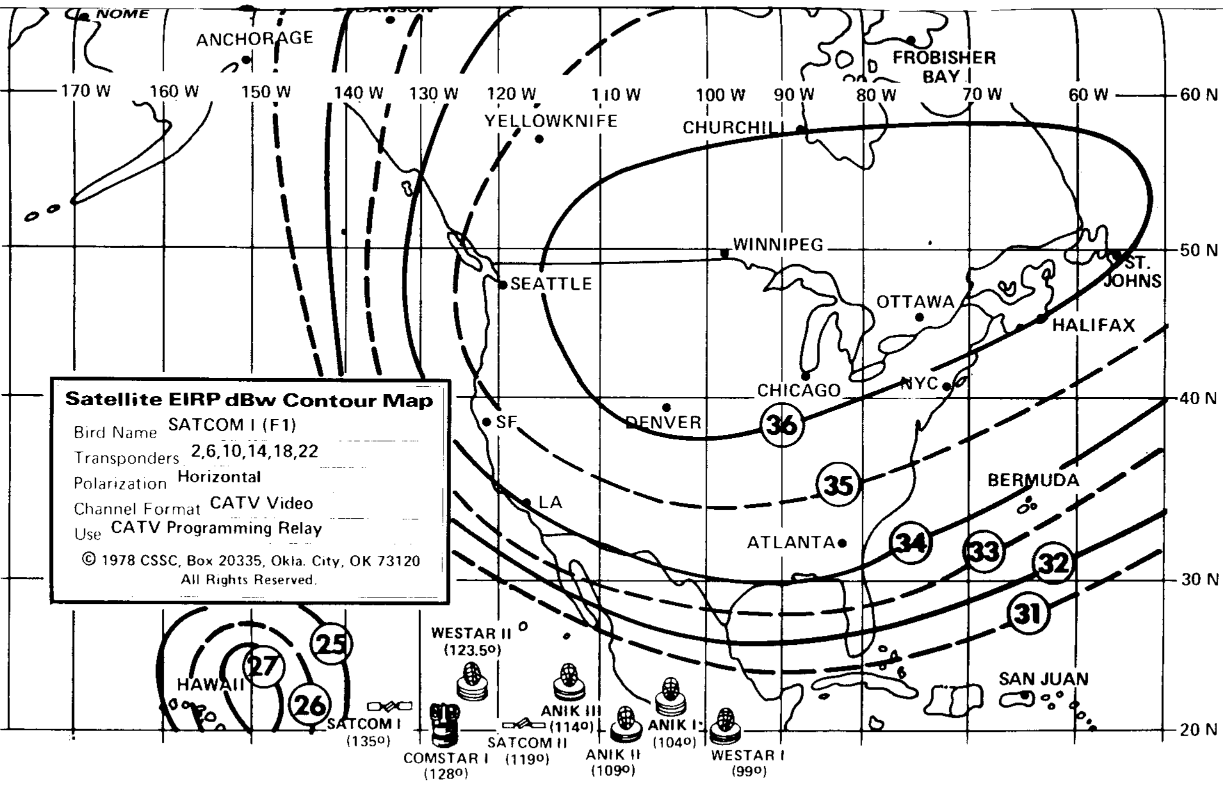
(on the ground) in your time zone go off the air for the day (say at midnight local time) stations in the Pacific time zone are just starting their 9 PM evening programming. A satellite viewer in Hawaii, can watch the 6 PM news at 1 PM (from New York), 2 PM (from Chicago), 4 PM (from San Francisco) plus tune in the evening news from Mexico City and Vancouver all before it is time to sit down to dinner in Honolulu!

THE SATELLITE REACH

Earlier we described the difference between the Intelsat (40% of earth covereage per satellite) 'birds' and the domestic satellites. If you have access to the large **Worldwide Communication Satellites** wallchart, this might be a good time to look at the special 'maps' found on the backside of this wallchart. One similar map appears here.

Engineers have developed a technique of 'forecasting' how strong the satellite signal is as it reaches various portions of the satellite's intended coverage or service area. These maps show this coverage with a series of ellipses or egg-shaped lines. Different satellites, even wwithin the domestic system, have different 'coverage patterns'. The center of the maps (where the 'dBw' number is **highest**, such as 36) indicates the region within the total coverage area where the satellite signal is **strongest** for the particular satellite in question. The Canadian ANIK, the U.S. WESTAR series 'birds' have approximately the same coverage patterns (or signal strengths) for each of their channels. However, the RCA (SATCOM) and the ATT/GT&E (COMSTAR) satellites have four separate antenna patterns **per** satellite. The ANIK and WESTAR satellites have a maximum capacity of 12 TV channels (simultaneously) while the SATCOM and comstar have a maximum capacity of 24 TV channels (simultaneously). To properly plan the receiving equipment required for a particular location, a system engineer (in professional circles) will compare the 'footprints' of each of the satellites of interest (to the viewer) and each of the channels of interest to some engineering design formulas. Using the 'weakest' signal as a starting point, he will then 'engineer' the antenna, the receiving electronics and the balance of the system so that on the weakest channel and satellite of interest the picture quality is 'perfect'.

A full set of maps (eleven in all currently) is available from a source listed in the reference section at the end of this Handbook. Most 'private' (as in non-commercial) satellite viewers don't get this sophisticated in planning their receiving systems and their ultimate system more often than not is a compromise between the number of dollars they are willing to spend on the project, and, the space they have available for the satellite



Satellite EIRP dBw Contour Map
Bird Name SATCOM I (F1)
Transponders 2,6,10,14,18,22
Polarization Horizontal
Channel Format CATV Video
Use CATV Programming Relay
© 1978 CSSC, Box 20335, Okla. City, OK 73120
All Rights Reserved.

THIS SPECIAL MAP - indicates the signal strength or level to be expected from the RCA SATCOM FI satellite (on the transponder/channels indicated on the map). Using these maps (a set of 11 is available) allows you to determine the type (size) of antenna, and LNA required for a particular area.

receiving antenna. Which brings us to the equipment itself.

THE RECEIVE TERMINAL

In the terminology of the satellite industry, the system you will one day install at your home is called a 'receive terminal'. To be very precise, it is a **'TVRO'** which translated means "Television - Receive Only" (satellite earth terminal). Satellite people have to define every part of their 'system' and since there are 'stations' (terminals) located both on the ground (i.e. earth) and in the air (i.e. space), and because some of these stations transmit (to the satellite) and receive(from the satellite), they like to keep everything properly defined. So from here on, the package of equipment that you may install for your home will be known as a 'TVRO'.

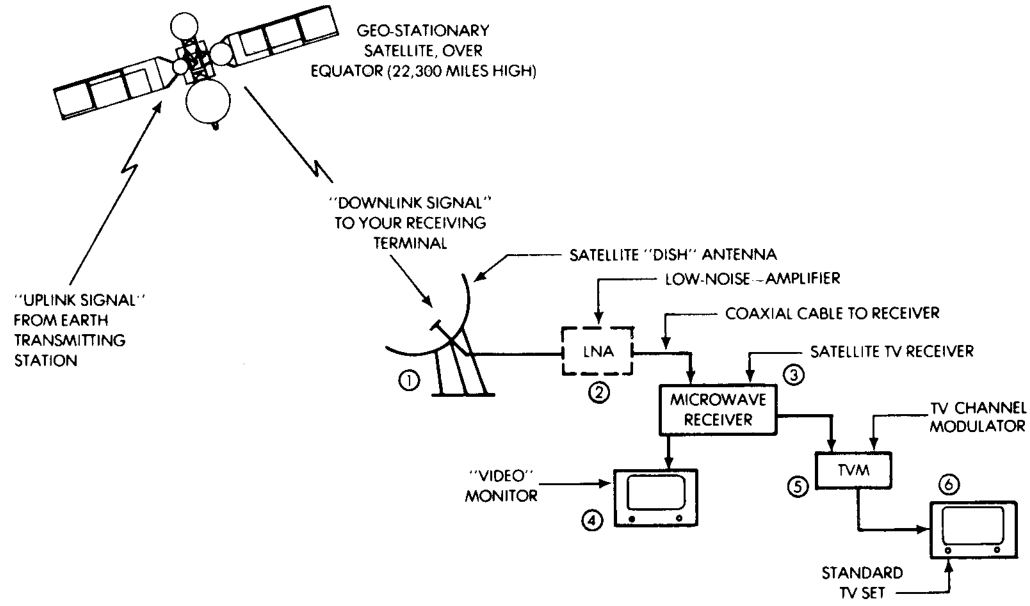
The TVRO consists of three basic parts:

1)**The receive antenna** - typically a shallow metal (or fiberglass impregnated with metallic particles) 'dish', shaped like a parabola, equipped with a mechanical system to mount the antenna just above the ground and pointed in a proper direction to receive the satellites. Some antennas are equipped with a mechanism to allow the 'dish' to be turned (i.e. rotated or re-directed) from satellite to satellite.

There is one basic rule of the dish antenna to remember. **The bigger** their diameter (or aperture as it is often called) **the higher** (or greater) **their** (signal) **gain**. The greater the 'gain', the more sensitive the antenna system. Which is another way of saying bigger antennas will receive weaker signals.

2)**The Low Noise Amplifier** (LNA) - this is akin to the 'antenna mounting TV signal booster' which folks who live in TV fringe (weak signal) areas employ to improve reception from distant ('fringe') stations. Only **this** 'antenna mounting signal booster' is a piece of space age electronics which has a price to match its exotic innards. The satellite signal received even by the larger 'dish' antennas is so weak that the LNA must be placed directly on the receive antenna to boost the weak signal(s) before even a few feet of cable (going to the receiver) can weaken the signals.

Between the LNA and the receiver (see diagram of complete system here) is another special 'part'. The (coaxial) cable which interconnects the antenna/LNA to the receiver proper must, because of the super high microwave frequencies employed, be very carefully constructed. This is typically 1/2 or 7/8 inch diameter air dialectric (insulated) cable known in the trade as 'Heliax'® and the price tag for this cable is $1.25 (1/2 inch) to $2.50 (7/8 inch) **per foot** region. In addition to


GEO-STATIONARY SATELLITE, OVER EQUATOR (22,300 MILES HIGH)
"DOWNLINK SIGNAL" TO YOUR RECEIVING TERMINAL
"UPLINK SIGNAL" FROM EARTH TRANSMITTING STATION
SATELLITE "DISH" ANTENNA
LOW-NOISE-AMPLIFIER
COAXIAL CABLE TO RECEIVER
SATELLITE TV RECEIVER
①
LNA
②
③
MICROWAVE RECEIVER
TV CHANNEL MODULATOR
"VIDEO" MONITOR
④
TVM
⑤
⑥
STANDARD TV SET

THE BASIC RECEIVE TERMINAL - consists of electronic 'modules' or boxes plugged together to make up the complete receiving system. Signal coming to your receive terminal from the satellite is called 'downlink signal'.

avoiding a big bill for lots of cable, you want to keep the length of this cable as short as possible (from antenna/LNA to receive proper) simply because all coaxial cable has 'loss' (i.e. satellite TV signal power is reduced) and the longer the cable, the less signal you have at the receiver.

3)**The satellite receiver** - is basically a 'microwave television receiver'. This is not something you will find on display at your local **Radio Shack** store (well, not yet anyhow) or in stock at the local appliance store. This (very) special receiver is currently being produced in rather limited quantities by a handful of U.S. firms specializing in exotic space age electronics hardware (sources of these firms are given later in the Handbook).

Unlike your home television receiver, this receiver does **not** have a screen nor a speaker. On the surface that probably sounds like a strange receiver if you can't 'see' or 'hear' anything with it! The TVRO receiver has two outputs or jacks on it which 'deliver' pure video and audio to the system operator. To **watch** the video (picture) you must connect the video jack to another box that has a screen on it. **Or**, you connect the TVRO receiver video to a box called a 'modulator' which translates the video signal to a standard TV channel which you can **then** tune-in on a standard TV receiver. The box with a screen is called a 'video monitor' and this is just like a TV set except it has no channel selector attached. It simply displays the video that comes to it from the receiver proper and you change channels by changing the channel changing knob on the TVRO receiver. In either case, the audio (sound) goes through the same procedure; plugging either into the 'modulator' or the 'video monitor' to give you a complete set of programming. This all says that a satellite (TV) receiver is more **like** a 'converter' than a pure receiver because in a sense it 'converts' the super high frequency microwave signals from microwave to a very low set of frequencies (video and audio) which you then further 'process' before you can view them.

TESTING COMMERCIAL RECEIVERS - two commercial receivers (right of center) are 'stacked up' for test in a field situation while engineer operating system switches channels. Top 'radio' is Terracom while bottom (black faced) unit is Microdyne. Both are 24 channel tuneable.

4)**TV modulator** - is the box that accepts the video and audio signal outputs from the TVRO (microwave) receiver (converter) and then re-converts these video and audio signals back to an electronic 'format' which you can tune in with a standard TV receiver. A TV modulator is a fairly simple device similar in concept to a TV station transmitter; only rather than plugging in a TV camera (video) and a microphone (sound), you plug in the microwave-converted-to video and audio signals from the TVRO receiver.

5)**The TV receiver** - in your home becomes the final link in the system. It is connected to the TV modulator and in fact dozens or hundreds or even thousands of receivers can be connected to one modulator through appropriate (low cost this time!) coaxial cable as a means of 'sharing' the satellite programs. This is, basically, what a cable TV (CATV) company does.

If all of this sounds like a great deal of equipment 'just to watch television', lots of complications and expense . . . fear not. The total skills required should not frighten away anyone with average intelligence and the ability to utilize normal hand tools.

WHAT CAN YOU SEE?

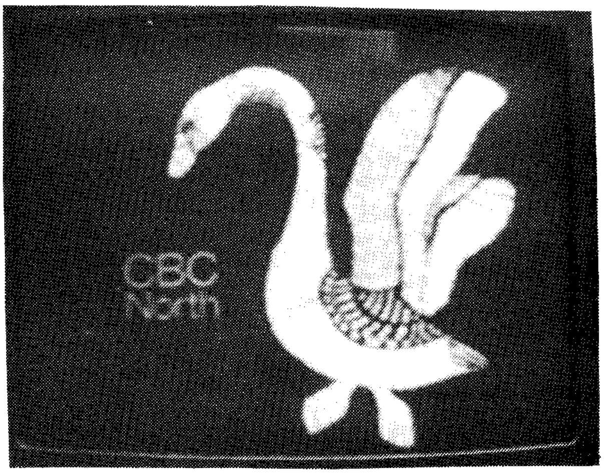
All of the equipment in the world is not good for much except for display on a shelf unless there is something out there to receive and watch. It turns out there is a great deal to receive and more becomes available every month.

All of the satellites we will discuss here operate in the **same** frequency band. A logical question might be "What insures that the signal(s) from one satellite does not interfere with the signal(s) from another satellite at the receiving location?"

The antenna is the answer. Even though by international agreement satellites are assigned to locations above the equator in 4 to 5 degree (of longitude) steps, as 'seen' from your ground location these 4 to 5 degree 'spacings' are sufficiently far apart that the directivity (i.e. selectivity) of your antenna can separate one satellite from another. RCA's SATCOM F1, for example (this is the satellite with the bulk of the CATV type programming available) is located at 135 degrees **west** currently. Late this fall, it will be 'shifted' to

136 degrees west. By maintaining a minimum of 4 degrees of longitude **between** the satellites, they can operate and not interfere with one another at your location. This also allows you to move your antenna left and right (i.e. east and west) in 4 to 5 degree increments and 'change satellites'. We'll talk more about how this works shortly.

Each satellite has multiple channels operating. WESTAR AND ANIK satellites have the capacity (with all transponders functioning) of relaying 12 separate TV channels or programs; SATCOM and COMSTAR have 24 programs each. However, not all of the available transponders on any satellite are used for television. Many are used for the relay of telephone conversations (up to 900 per transponders typically), teletype (the wire news services), private business voice and data channels (the TV networks, for example, maintain 24 hour 'order lines' between New York and Hollywood/Burbank which they use extensively to manage their operations) and so on. The number of television-used channels varies from a few at off-hours to many at peak times. You might tune-in WESTAR II at 123.5 degrees west (this is its location in longitude) at say 4 AM and find one TV program, plus a color-bar test pattern on another channel. **Twelve hours later** you might find 6 or 7 channels in use for television. Simply put, you select the satellite first by pointing the antenna at the appropriate spot in the sky, and then you tune your receiver through the satellite transponders/channels (*) to determine what programming is available.



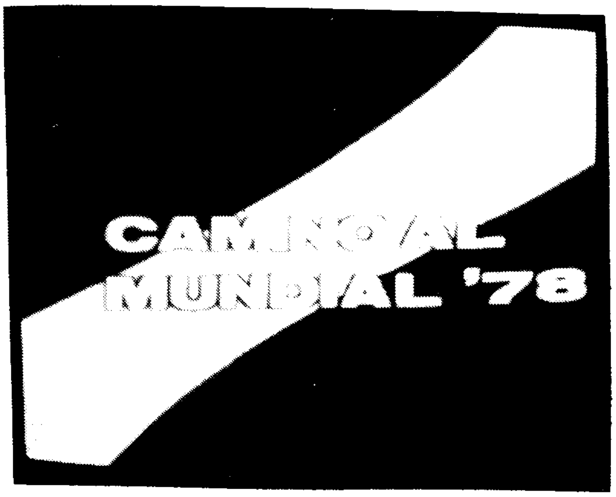
CBC NORTH - one of the three Canadian service cnannels found on ANIK.

*** - This general statement assumes you have the proper authority or 'right' to be tuning in the various channels in question; a subject to be discussed in depth.**

The United States allows private firms to own and operate satellites and their systems. We are unique in this regard in the world; virtually all other satellites are owned and operated by either government agencies or consortiums of government and private groups. At the present time there are **seven** U.S. privately owned satellites in operation (see list at back of Handbook). Four carry television on a regular basis, and the other three (owned by ATT & GT/E, the COMSTAR SERIES) can be expected to start carrying television very soon. Additionally, there are two additional U.S. satellites scheduled for operation over the next few months; a new WESTAR (III) satellite to go into service in September and a new RCA SATCOM (III) to go into service sometime between November and February (1980).

Additionally, there are now three operating Canadian (ANIK) satellites, one of which carries television on a regular basis and a second of which is scheduled to carry several television channels within a year or less.

As noted, the WESTAR and ANIK series satellites have the capacity to carry up to 12 television channels each. Each channel is 36 MHz wide (that's a measurement of how much 'space' it utilizes in the spectrum) and if you multiply 12 times 36 you have 432 MHz of the 500 MHz available in use. The balance is used for operational purposes for the satellites. WESTAR and ANIK satellites transmit their signals back to earth with something called 'horizontal polarization'; a definition of how the downlink signal is 'polarized' with respect to the earth. RCA's SATCOM and the COMSTAR series satellites attain **24 channels** in the **same** 432 MHz of space by sending one set of 12 channels via the standard horizontal polariza-



SIN - Spanish International Network is a 12 (+) hour per day channel carried on WESTAR II delivering Spanish language television, primarily from Mexico City, to television stations and cable systems throughout North America.

tion. In effect, this allows use and re-use of the same spectrum space **two times** since at the receiving site you can orient your antenna to receive either polarization independent of the other's presence. A receive terminal set up to receive horizontal-only polarization will tune in all of the ANIK, and WESTAR channels and half of the SATCOM and COMSTAR channels. To receive both the horizontal **and** vertical channels **from SATCOM and COMSTAR** the terminal is outfitted with either a simple motor to 'rotate' the feed portion of the antenna from one polarity to the other, or it is outfitted with something called a 'dual pole feed' which allows you to receive both polarizations simultaneously.

If you sum (or total) the number of transponders available to carry television to North America today you find:

1)**WESTAR** - two operating satellites with 12 channels each, total of 24 channels.
2.**SATCOM** - two operating satellites with 24 channels each, total of 48 channels;
3)**COMSTAR** - three operating satellites with 24 channels each, total of 72 channels;
4)**ANIK** - three operating satellites with 12 channels each, total of 36 channels.

That works out to 180 channels of **capacity**. Add to this another 12 channel WESTAR and a third 24 channel SATCOM and you have a total capacity in the sky of 216 channels. That's a lot of television in anyone's book.

Now how are they utilized?

Television programming on satellite falls into two broad categories. There is **regularly scheduled** programming, and, there is '**occasional use**' programming. Virtually all of the regularly scheduled programming is on satellite to interconnect to the cable television systems throughout the U.S., or to interconnect television stations that are a part of a national network. In a sense, this is programming that is intended, ultimately, for the public or some segment of the public. Which is another way of saying that this 'regularly scheduled' programming is not **private** in the usual sense of the word.

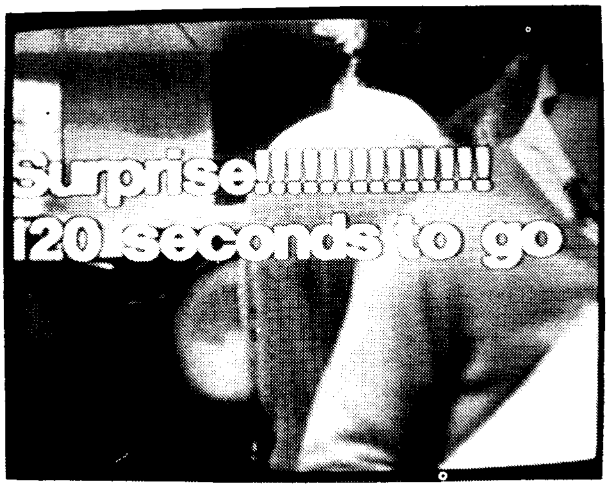
On the other hand, much of the 'occasional use' programming is intended for specific receive terminals. One example would be the annually produced teleconference held in the fall between participating native American Indians (in the southwest) and Alaskan natives during which the two 'related' groups discuss quite frankly and openly their 'common problems' with the Federal government. This is a private discussion, not intended for the public.

Yet another example of this 'occasional' (and certainly private) programming might be the use of satellite relay by one of the major (U.S.) television networks to show their affiliates (and network brass) "previews" of upcoming programs or specials or the forthcoming 'new fall season'. *These transmissions*, interspersed with sales and operational messages for network affiliates are strictly private and are not legally 'interceptable' by unauthorized 'third parties'.

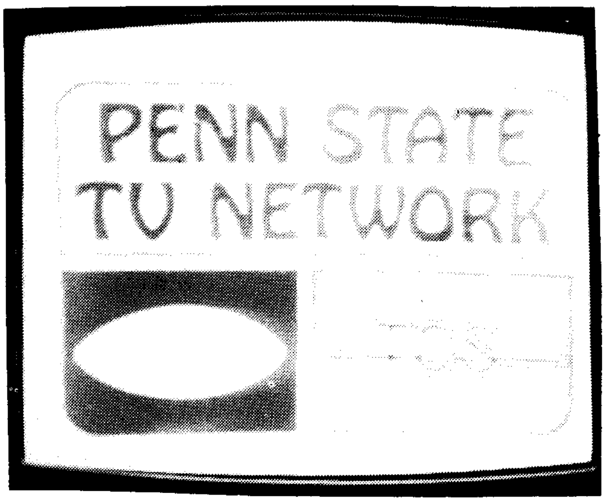
In between these two broad categories fall yet another group of transmissions; one frequently 'run into' by the person who spends time 'tuning around' the satellite channels. TV networks make regular (although not scheduled) and frequent use of the satellite relay service to transmit **portions of programs** from someplace close to where they occur back to network headquarters in New York (or Los Angeles). For example, between approximately 3 PM and 6 PM daily on the WESTAR satellites and on RCA's SATCOM F2 satellite you will find from a couple to perhaps a dozen channels in use transmitting news events and news film from locations throughout the U.S. back to CBS, ABC, and NBC news in New York. The satellite is simply a delivery vehicle, and dozens and dozens of 'news stories' go from 'the field' back to network headquarters in this way. A relatively small percentage of these 'news feeds' ends up making it to the network newscasts for that date; most are 'lost on the cutting room floor'. But the decision of what to use, or how much of a report to use, is made in New York after all of the field reports have been collected. A similar use of the satellites is made by the network sports departments. **Whole events** (such as a tennis match from Wimbledon) are transmitted to New York and then **edited down** for later showing in an abbreviated form. In a sense, **parts of these satellite transmissions** become public later that day (or within a few days) when, after editor selection, they are placed on the regular terrestrial tele-

STRICTLY PRIVATE - annual gathering via satellite of Alaskan natives and American Indians is a two-way 'teleconference' using the satellite to link these two geographically spread groups together for a several hour dialogue of their problems with Uncle Sam!

vision networks. But . . . **while** they are being transmitted via satellite **to** network headquarters they are the private material of the networks. They are not intended for public viewing, only for the network personnel assigned to the editing task although within a matter of minutes, hours or days some parts of what is sent via satellite may in fact become 'public'.



TIME TO PLAY AROUND - network technicians and personnel love to 'play around' with the fancy equipment just ahead of and after the regular program times. Via satellite you see all of this fun and games which is 'edited out' from local terrestrial television. Here a control room person uses the character generator to let everyone know that in two minutes time they will be 'live' into millions of homes.



SPECIAL NETWORKS - are literally all over the satellites. The Penn State TV Network carries Penn State football games to eastern cable TV systems during football season; typically on transponder 20 of SATCOM F1.

A popular regular program is sent via satellite, often in a slightly different 'form' than as seen in homes across America later in the day. NBC produces the **Johnny Carson/Tonight Show** in Burbank, around 5 PM California time. It airs on the network around 3 hours later, starting on the east coast and working west by time zones. The Burbank poduction is sent 'live' to New York where minor 'editing' (such as the bleeps you hear eliminating 'nasty language') takes place. Many of the commercials, through the years, have been added at New York. During those periods when the program is into a commercial break, or as the program is starting and ending, the 'satellite version' differs from the later-released network version because the cameras and microphones continue to run 'hot' while the performers believe they are 'off the air'. Again, this is a private program (via satellite) at this point, and it is not intended for public viewing.

TYPICAL TEST PATTERN - when transponders are not busy with programming material, color bar test pattern (Western Union, New York Toll Operations Center here) is seen.

In the reference section of this Handbook, towards the back, you will find a listing of the satellites and the transponder/channels available as a guide towards what you can generally expect via 'bird television'

RESTRICTIONS TO RECEPTION

Much of the prior section has alluded to the matter of 'privacy' of satellite communications. What is this all about?

In 1934, when the U.S. Congress created the '**Communications Act of 1934**', it vested certain regulatory powers in a federal agency that has become known as the Federal Communications Commission (or FCC). The FCC creates the rules, regulations and policies which govern the day to day administration of communications in the United States.

One of these regulations sets forth the distinction between 'public communications' and 'private communications'. Another rule sets forth the procedures to be followed when you as an individual "intercept" or "access" (accidentally) a private communication that is **not** intended specifically **for you**.

Regular radio and television broadcasting, such as you enjoy in your home, is **public** communication. Anyone with possession of a receiver can tune in (intercept) the transmissions that are intended for the public at large. No special permission or permit or license is required and in the United States receivers have no annual license fee or use tax attached to their use.

Satellite transmissions as a 'class', on the other hand, are generally **considered to be** 'private transmissions' intended for specific recipients and by FCC theory **anyone** engaging in satellite transmissions is **supposed to have** the written authorization of the program supplier or satellite operator to engage in such reception. There are two reasons for this line of reasoning:

1)Some of the transmissions via satellite are **definitely** private. As pointed out, many of the television 'events' sent via satellite have specific 'addressees' or participants (the Alaskan Native Teleconference for example). Still others are the private **property** of some person or corporation until such time as that person or corporation willfully agrees to 'share' the material with the public at large (the network news, sports, program pre-feeds for example). Additionally, the satellites have thousands of private telephone and message channels in operation. "Tuning in" someone's private telephone call might be intriguing, but legally it is 'eavesdropping' and is clearly illegal. It is no different than 'tapping a telephone' or opening someone else's mail.

2)All of the balance of the programming material is owned by somebody. It is a commodity to be sold, by the owner, to those people or firms who are willing to pay for its use. The owner has certain ownership rights, just as the author of a book has creative rights for his work. The owner has his programming on the satellite because the satellite is his distribution 'vehicle' or medium. He looks upon the satellite transmission like you would look upon a common carrier truck line to which you have assigned a package you are shipping. He expects that the satellite 'common carrier' will 'protect his product' while it is being 'delivered' by their transportation system.

A cable television programming company, such as HBO (Home Box Office), **rents** the use of a movie product (such as **Smokey and the Bandit** or **Buck Rogers in the 25th Century**) from the owner of the film product. HBO then leases satellite transmission 'time' from RCA and arranges to transmit the movie feature(s) to its clients; the cable television system operators spread throughout the United States. The cable firm installs a satellite receiving terminal, such as described here, and arranges to interconnect the HBO program channel through its local cable system into homes of cable subscribers who have agreed to pay **extra money per month** to receive the HBO 'premium service' channel.

The money taken in by the cable company, from the cable subscriber, winds its way back to the owner of the film via HBO.

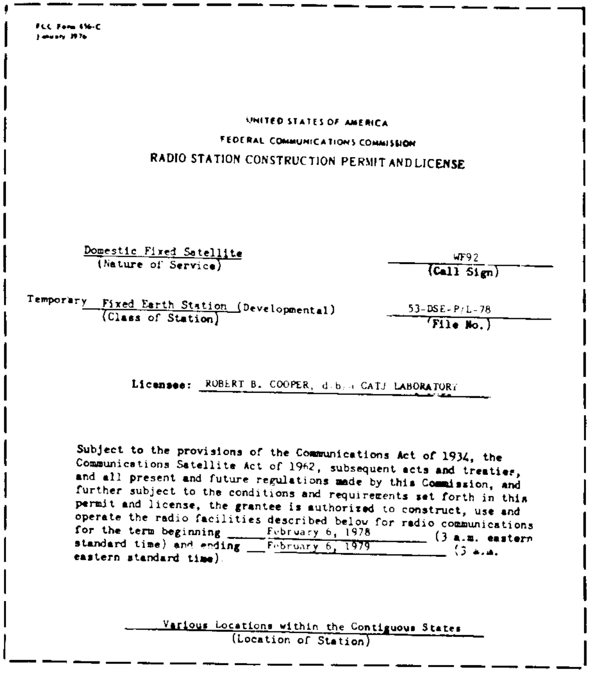
HOME THEATER NETWORK - like HBO, SHOWTIME, STAR CHANNEL and others specialize in first run, un-edited movie fare.

If you set up your own 'backyard' or 'private' satellite terminal, and you 'intercept' the HBO program channel without having an agreement with HBO to pay them so many dollars per month for the service, you are in effect stealing from **(1)** HBO, and, **(2)** the people who own the rights to the movies and other programs which HBO utilizes.

Policing the system was not much of a problem until recently. As long as satellite television terminals cost upwards of $25,000, very few people could be expected to install such a terminal and engage in 'illegal interception'. However, with the prices of satellite hardware tumbling (as we shall see here) a different type of problem now arises; **just how many private**, non-paying backyard terminals can HBO (et al) and the program rights owners 'stand' **before they make a move to tighten up the security** of the 'system'? Nobody knows the answer to this question. It is possible that **some** (although it is likely to be a minority of the total) of the satellite channel operators will, lacking some legal or marketplace mechanism to collect money from these 'private terminal viewers', create a 'scrambled transmission system' for their satellite telecasts. A scrambled system simply means that a smart electronic engineer mixes up the television picture being transmitted so that a special add-on electronic box at the receiver must be installed to 'decode' or 'unscramble' the transmission. Such systems are already in use on a smaller scale within some of the more advanced cable systems (where HBO is 'scrambled' on the cable as a security measure) and in areas such as Los Angeles and New York and Boston where over-the-air "pay television" is in operation. This 'scrambled approach', if it comes, is most likely to impact only on some of the high-priced movie channels, such as HBO, SHOWTIME and perhaps Warner's STAR CHANNEL. Other services such as WTCG, WGN, KTVU, WOR, Nickleodeon, the three religious channels and so on are **not likely** to adopt such a scrambled system simply because their programming 'sells' for far less per (cable TV) home per month than do the 'premium movie' service channels.

The FCC **is** concerned about this question and there is expected to be both debate and perhaps modifications of the existing FCC rules in this area during the fall of 1979. As the situation **now** stands there are several **legal** options open to the private terminal enthusiast (the illegal one should be obvious).

1)The FCC has been granting something called an 'Experimental/Developmental License for this 'Fixed Earth Station' radio service. Satellite pioneer Bob Cooper was licensed (under the call letters WF92) for his 'experimental terminal' in February of 1978. Having such a license (there is no license fee) is one way to be legal with **the terminal equipment** itself and a set of instructions detailing how to get such a license is available from: **TVRO License Instructions, % CATJ Magazine, Suite 106, 4209 N. W. 23rd, Oklahoma City, OK 73107.** The cost of this package of material is $5.



FCC Form 456-C
January 1976

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION
RADIO STATION CONSTRUCTION PERMIT AND LICENSE

Domestic Fixed Satellite
(Nature of Service)

WF92
(Call Sign)

Temporary Fixed Earth Station (Developmental)
(Class of Station)

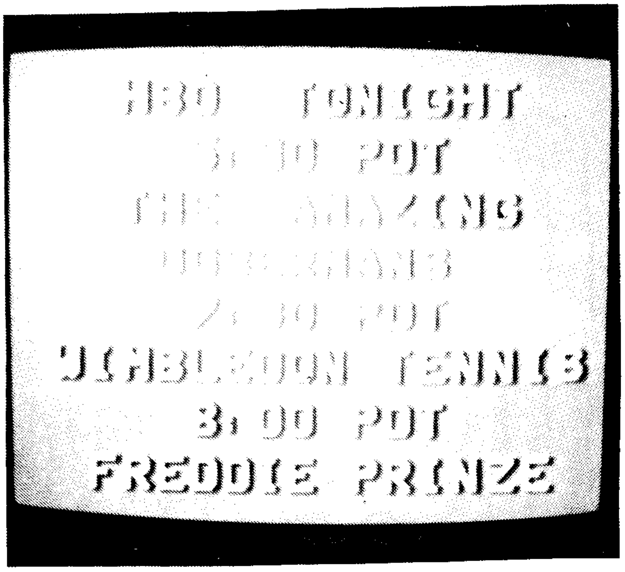
53-DSE-P/L-78
(File No.)

Licensee: ROBERT B. COOPER, d/b/a CATJ LABORATORY

Subject to the provisions of the Communications Act of 1934, the Communications Satellite Act of 1962, subsequent acts and treaties, and all present and future regulations made by this Commission, and further subject to the conditions and requirements set forth in this permit and license, the grantee is authorized to construct, use and operate the radio facilities described below for radio communications for the term beginning February 6, 1978 (3 a.m. eastern standard time) and ending February 6, 1979 (3 a.m. eastern standard time).

Various Locations within the Contiguous States
(Location of Station)

FCC LICENSE - granted under experimental or developmental basis to Bob Cooper allows Coop to 'experiment' with the development of satellite hardware. FCC is expected to change licensing requirements for service before end of 1979.



HBO TONIGHT - premium program service channels, such as HBO, utilize the service itself to promote upcoming programming; this listing of the day's programming in the early evening period is typical of such listings.

2)Several commercial TVRO suppliers, notably Scientific Atlanta (through their 'HOMESAT' division) and Gardiner Communications Corporation (see listing of both in Handbook reference section) are preparing license applications for people who purchase **complete terminals** from them. These license applications typically **include** an annual prepayment of a program-use-rights fee for the satellite channels which you elect to receive.

3)There has been some talk of forming a 'program viewers cooperative', notably by Ed Taylor of Southern Satellite Systems (again, see Handbook references) through which private viewers could secure a 'license' or permission to tune in various satellite channels, make an annual one-time prepayment for the services selected, and in turn receive monthly advance printed programming schedules for the channels selected.

We are really dealing here with two separate sets of 'permission'; one of which may be eliminated very shortly. In the first case, you **presently are required** to obtain the permission of the FCC, in the form of a 'license to operate the terminal', to build and turn on the terminal itself. **However,** hand in hand with presently required FCC license also must go permission from one or more 'program suppliers' who have programming on the satellite. The FCC authorizes you to construct the terminal equipment **contingent upon** your having an agreement with one or more program suppliers to tune in their programs.

What the FCC is **likely to do** this fall is to eliminate the **requirement** that you have a license from them (although they will probably keep that open as an option should you wish a license), replacing their licensing with a simple 'terminal registration' process whereby you will be required to notify them of the existence of a terminal when you install one. If this comes about, there will no longer be an FCC licensed procedure but the requirement that you obtain the permission of a program supplier (one or more) before inaugerating 'service' with the channel will remain. In that regard:

1)Writer Bob Cooper produces a weekly television program entitled '**SATELLITE MAGAZINE**' which airs every Thursday at 12 noon eastern (etc.) on RCA SATCOM transponder 21. Individuals wishing to have the written permission of 'one' program supplier are generally granted permission by Cooper who may be reached via Satellite Television Technology (address on inside front cover).

Many people ask if there are restrictions as to **how** you use the signals, once having decided how you will be legally entitled to receive them. Could you share the programs with others?

That depends upon how you set out to 'share'. A cable television system is a prime example of a large 'shared facility'. Through one satellite receiving system,dozens or hundreds or thousands of homes are interconnected to the same system via coaxial cable.One satellite terminal,shared between two (or three, etc.) neighbors is really, in theory, a 'miniature cable TV system'. The FCC looks upon such installations and says that **if** there are **49 or fewer** 'residences' connected to the single antenna, the system does **not** meet its criteria for a cable system. **That's good**, if you fit into that category, since the FCC maintains very complex and often confusing and contradictory 'rules and regulations' for cable systems. So 49 or fewer residences **could share** one satellite TV antenna system without being a 'cable system'. That leaves the problem of paying for the services received. If you reached an annual rate agreement with SHOWTIME, for example, for viewing their 12 hour a day movie package in your home via your private terminal, what happens to that 'rate' if you go ahead and connect a neighbor to the system? **It doubles**. For three homes, it triples, and so on. The premium-movie channel operators such as SHOWTIME or HBO have no real 'bulk rates'. They buy the rights to show movies and specials based upon a flat charge of so much per home per movie. Each home added results in an increase in their costs, and consequently their bill to you. So there is no 'progamming rights money' **to be saved** by sharing the service with a few neighbors via a few hundred feet and ten dollars worth of low cost coaxial cable strung along the back fence line. **Where you will save money**, if you can reach the proper agreement with the neighbors, is by splitting up the initial cost(s) of the terminal itself.

FUTUREWORLD - movies are a major part of the viewing fare seen on 'premium service channels' such as HBO, SHOWTIME, FANFARE, HTN and STAR CHANNEL.

Can you place a terminal into a condominium development, an apartment complex, or a trailer park and operate it as a business by 'selling' the satellite TV service? Again, if you can stay at or below 49 'residences' or 'outlets' connected, you can avoid being a formal "cable TV system" and do this without a bunch of federal paperwork. Beyond that level, you will be called a cable TV system and will be regulated as such by the FCC. See reference section at end of this Handbook.

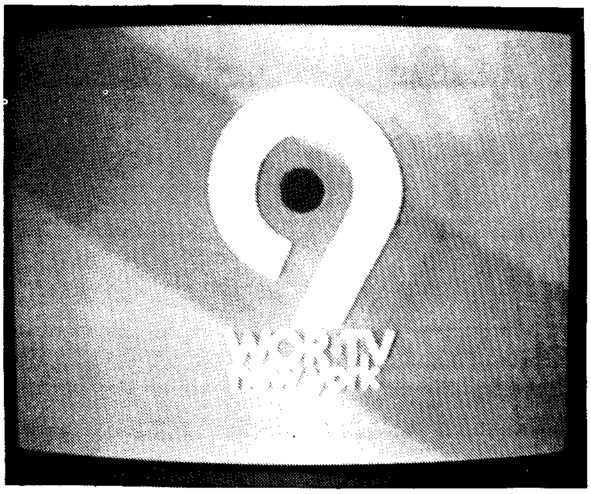
What about installing the terminal in your backyard and watching the (authorized) signals in your own home, and then videotaping (some of the) movies seen and 'sharing' those videotapes with others? **A very murky legal area at best**. If you yourself have authorized reception, that permission extends to **you** enjoying the movies (etc) in **your** home. If you videotape the movies and **loan** (free of any charge) the movie tape to a 'friend', you are pushing the limits of the agreement between you and the satellite program supplier plus you are now breaking a federal copyright law. If you were to do this and charge a fee (**any** fee) for the tapes, you have moved out of the grey area into a clearly illegal area in as much as now you are profiteering from someone else's work and the property rights owner is not being compensated. It is not a serious crime, but it is starting to attract the attention of the courts especially when it is practiced on a wide scale. There is presently a very large 'underground' of so-called 'bootleg tapes' made from HBO, SHOWTIME, FANFARE and STAR CHANNEL services. Most of these tapes are made simply by living in an area where local cable firms offer such services, **subscribing to the service** (for typically $7 to $10 per month) and then using the cable service for taping purposes.

All of which says that in a fast moving technological world, the laws and regulations offer lag the technology by several years. It is a fair bet that this type of illegal duplicating (**via tape**) of premium movie services will spread even more widely in future years, rendering perhaps moot the so-called "illegal interception" of the same movies and programs directly from a satellite.

THE TERMINAL EQUIPMENT

Having been biten by the satellite TV bug and lured by the promise of 20 or 40 or more channels of very high quality television reception, what options does a person have **today** to acquire such equipment?

To date virtually all of the equipment installed has come either **(1)** from commercial firms established to supply satellite TV hardware to the cable TV and broadcasting companies using the satellite for commercial program relay, or, **(2)** from the inventive workshops of that American phenominon "the experimenter". In sheer volume, the commercial equipment has (to date) far outstripped the do-it-yourself sources. This perhaps may change in the next year, but for now the commercial suppliers have a commanding lead.



WOR NEW YORK - one of four non-network, independent TV stations currently available on satellite.

When the first cable television company opted to purchase a satellite TV terminal in the fall of 1975, it laid down more than $125,000 for a **single channel** TV receive system via satellite. The receiving antenna required then was by today's standards 'huge'; more than 33 feet in size. Even at that, in 1975 this was considered a 'bargain' because prior to the first cable TV terminal(s) the only users of satellite TV service were government agencies and national communication firms owned by governments. Until the first cable terminal was installed, a $700,000 price tag for essentially the same type of service was considered 'reasonable'!

Cable television was the first 'volume market' for satellite terminals. In the first year 75 were sold and installed. That doesn't sound like much volume, but at $100,000 (+) each it was a tidy new business area and during that first year the sophisticated (and snobbish) suppliers who had been in that field selling to national government agencies learned how to deal with (comparatively speaking) 'little people'. But the market for satellite TV terminals, in the $100,000 price range was limited; not many cable systems were large enough to afford such an expense. And there was the gnawing feeling that the whole terminal system was 'overkill'; that you didn't really **need** a big 33 foot dish antenna.

In 1976 Bob Cooper, then as Editor in Chief of the cable industry's magazine **CATJ**, set out to prove that smaller antennas (and therefore cheaper antennas and terminals) would work. First he pushed several small electronic firms into building test terminals, using antennas down to 15 feet in size. Then he got the ear of several U.S. Congressmen who sat on committees that had some direct influence on the FCC. One of these Congressmen, Lionel VanDeerlin of California, was sufficiently impressed that he directed the FCC to 'prove' **why** cable TV firms **had to use** antennas 30 feet in size or larger. The FCC could not, and Cooper drafted a 'Petition For Rule Change' which resulted by December of 1976 in the FCC removing the antenna size restriction.

That started a rush to the satellites. Before 1976 was over Atlanta's WTCG got FCC approval to be distributed nationwide via satellite, and several firms appeared on the market with $35,000 satellite terminals utilizing 15 to 20 foot antennas. In another year there were **ten** cable programming **channels** on satellite and cable terminals had dropped to under $20,000. Today there are more than 25 cable service channels available with a dozen or so additional channels **waiting for RCA to launch** a third satellite late in 1979; and a cable system can purchase a (**single channel**) satellite terminal for under $10,000; complete and installed.

Obviously as the receive antenna becomes smaller in size, it has less gain or sensitivity. At some point in size reduction the antenna becomes too small to be effective. How small can the antenna be and still produce high quality pictures?

This is a function of the 'satellite footprint area';

or the place you are located in North America versus the satellite's signal level over the continent. In earlier pages in this Handbook we discussed the 'contour' or 'coverage' maps as they appear on the backside of the **Worldwide Communications Satellites Wallchart**, and as an earlier illustration in this Handbook. As a rule of thumb:

1)If your location is within a 35 or 36 or 37 dBw 'contour region', for the satellite (and transponder channels) you wish to receive, you can with the appropriate set of electronics (LNA plus receiver) produce perfect quality reception (i.e. perfect means no noise or blemishes) with an antenna only **ten feet** in diameter.

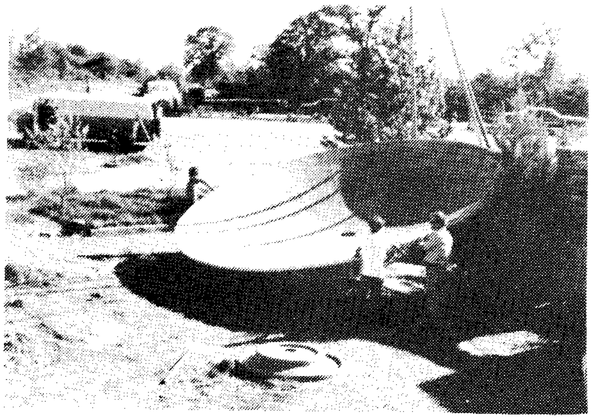
If, again with the proper electronics, you are located in a 33 or 34 dBw contour region, it will take a **15 foot** antenna. And if you fall into a 31 or 32 dBw region, we are talking about a **20 foot** antenna.

These are the minimum antenna sizes for perfect reception if you are using the top grade of electronics available (LNA and receiver). If you use a lower grade of electronics, you have to make up the margin someplace and that says you have to increase the antenna appropriately.

Since many antennas are listed in 'meters' rather than in feet, the handy conversion between the two in this industry is:

10 foot diameter = 3 meters
15 foot diameter = 4.5 meters
20 foot diameter = 6 meters.

What if your goal is to have perfect-plus pictures on all transponders on all satellites? Probably the biggest antenna you can reasonbly fit into a **private** residence area is the 6 meter (20 foot) size. A larger antenna (than required) for minimum-perfect service also allows you a 'margin' for equipment deterioration should the receiving station and/or the satellite itself drop in efficiency over a period of several years.



INSTALLING TWENTY FOOTER - 6 meter USTC antenna being installed at Coop's place in 1977. Antenna is all steel construction.

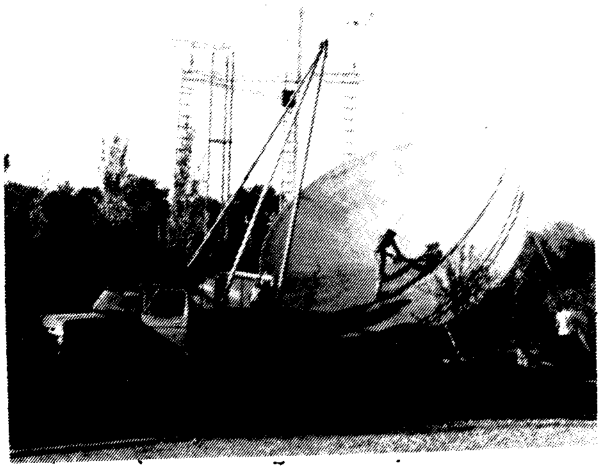
What about smaller antennas; say 6 or 8 feet in size?

Yes, it is possible to get reception with smaller antennas. If you were located right square in the middle of say a 36 dBw contour, an 8 foot antenna would come very **close** to providing perfect reception **if** everything was exactly up to snuff. The same location and a 6 foot antenna would produce degraded (i.e. noisy) signals. That's not theory . . . that's the results of extensive tests run by Cooper at his own laboratory site.

On the front cover of this Handbook is a photo of the author's daughter (Tasha, age 6 at the time) with a 6 foot (1.87 meter) satellite TV antenna under test. It works (as a report in **CATJ** magazine detailed in October of 1978) but if you will not be satisfied with **less than** perfect pictures, it misses the mark by a noticeable margin. And that was with the very best electronics available in the world in the fall of 1978.

Will the electronics get better, so that maybe this fall or next fall a person could in fact use a small antenna such as this six foot? No and here is basically why.

When antennas get too small (and anything under 8 foot in diameter qualify for what follows) they start to pick up 'noise' from the earth itself. That noise degrades the picture quality, as interference, in spite of the best electronics available. Since earth (or terrestrial) noise is present as a basic law of physics, it seems unlikely that for the present generation of satellites operating as they do with very low transmitting powers (5 watts of transmitter power is all that is being used on board the satellite; the same as a CB set!) that we will clear the 8 to 10 foot hurdle. Perhaps someday, as more powerful satellites are launched, this will

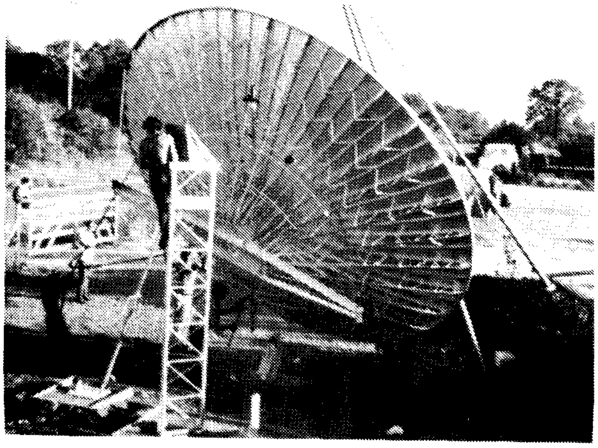


LIFTING DISH TO MOUNT - required use of winch and A frame hoist system. Fortunately for you, large twenty foot antennas are no longer a requirement!

change. But for now, the 8 (and better yet 10) foot minimum seems to be the end of the line in reducing antenna size.

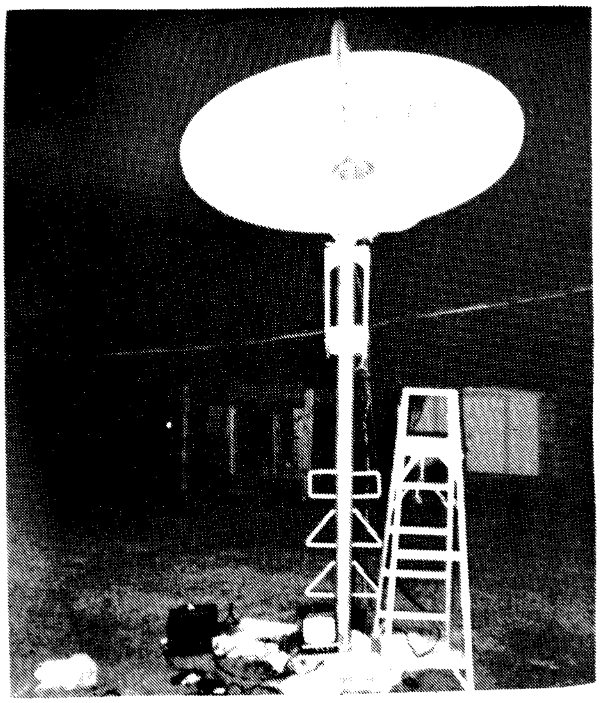
This would be an appropriate point to bring out that certain trade-offs can be made between the size of the antenna and the electronics in the system. As we shall see in a following section, as long as you are not working **at** the minimum antenna size practical (ten foot generally if in an ideal footprint area), you can perform trades between antenna size and electronics. For example, if you select a particular caliber of LNA (low noise amplifier), you will find that the combination of that amplifier plus an antenna of some minimum size will equal a perfect picture. At that point you will also learn that you could graduate to a larger antenna, and reduce the caliber (and cost) of the LNA. Other than the esthetic problems with (larger) antennas, there is much to be said for having a larger antenna than required since it provides the foundation for the whole system.

The least complicated method of installing a TVRO is to 'hire it done'. This is called the **turnkey approach** and it simply means you select a supplier who agrees to provide the equipment, and install it, and do whatever (usually minor) adjustment as may be required. When he is finished, you 'turn over to him' a check for the agreed to amount, and he 'turns over to you' the installation. This is also the most expensive way to go since the supplier marks up everything he touches. However going this way gives you the peace of mind of knowing that it will be done and done right, that it will work to your stisfaction (or logically you won't pay for it), and that your only real involvement will be pointing out where in the yard the antenna should sit, and arranging to pay for the work!

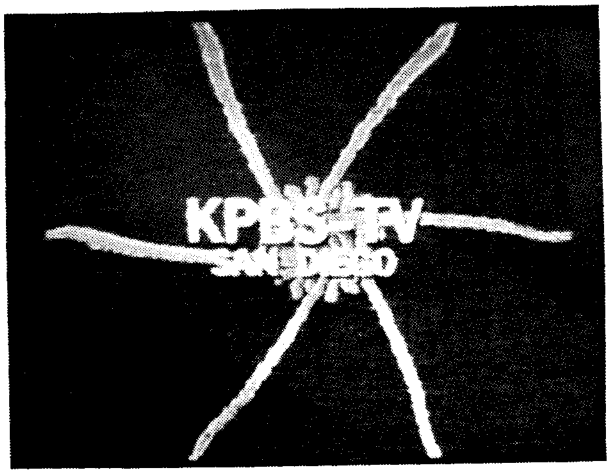


INTO POSITION - twenty foot surface is now in place and shortly will be producing satellite TV pictures.

Depending upon the antenna size and the caliber (and amount) of electronics selected, you are talking $10,000 and up for this approach. *If you* have more than one satellite receiver (a single antenna and LNA **can supply** signal to perhaps as many as 12 receivers if need be) so as to be able to watch more than one satellite channel simultaneously (remember the 'channel tuner' is on the receiver so with one receiver you watch one channel at a time), that will drive the price up somewhat. The Scientific Atlanta HOMESAT



SIX FOOT EXPERIMENTAL TERMINAL - Coop's Lab was outfitted with 100 degree K low noise amplifier and high quality 24 channel tuneable receiver for tests. With higher power satellites in 1985 time frame, such 'small' antennas will be feasible for high quality reception in North America.



SIX FOOT PICTURE - noise in picture is called 'sparklies' in the trade. It looks similar to 'snow' (noise or interference) on terrestrial television but appears in bands or bars with streaking across the screen.

Division that sells terminals to ranchers and other remote folks talks of a **four receiver package**, complete and installed, in the $23,000 to $25,000 range just to give you some idea of what the upper limits of the top-of-the-line approach might be.

If this is too rich for your blood, the next step 'down' is to acquire all of the TVRO hardware (primarily the antenna, the LNA and a receiver plus modulator) from commercial suppliers and provide your own concrete and labor to put it in. Most terminals require around 20 hours time which means two men for one long ten hour day. First-timers might allow an extra ten hours. Pricing on the essential ingredients is changing fast; fortunately the trend is downward. You should be able to locate brand new, off the shelf commercial TVRO hardware in these price ranges from suppliers listed in the reference section of this Handbook:

Antennas

1)**Ten foot** with 'polar' mount and feed - $2200 'list', down to $1600 with discounts

2)**Twelve-thirteen feet** with 'polar' mount and feed - $3300 to $4000 list, down to $3100 with discounts

3)**Fifteen-sixteen feet** with 'polar' mount and feed - $3,900 to $5,000 list, down to $3800 with discounts

4)**Twenty foot** with 'polar' mount and feed - $6,200 to $8,200 list, down to $5,800 with discounts

LNAs

1)**100 degree** (best grade available) - $2800 to $3200

2)**120 degree** (must frequently employed grade currently) - $1100 to $1600

3)**150 degree** (often specified for private terminals) - $1000 to $1300

4)**180 degree** (often used as lower grade standby units by CATV systems) - $800 - $1000

Receivers

1)**Single channel**, 'screwdriver tuneable' with some effort - $2200 to $2800 with discounts

2)**12/24 channel tuneable** - $3000 to $6800

Modulators

1)**Low quality MATV** (master antenna television system type) units - $250 to $400

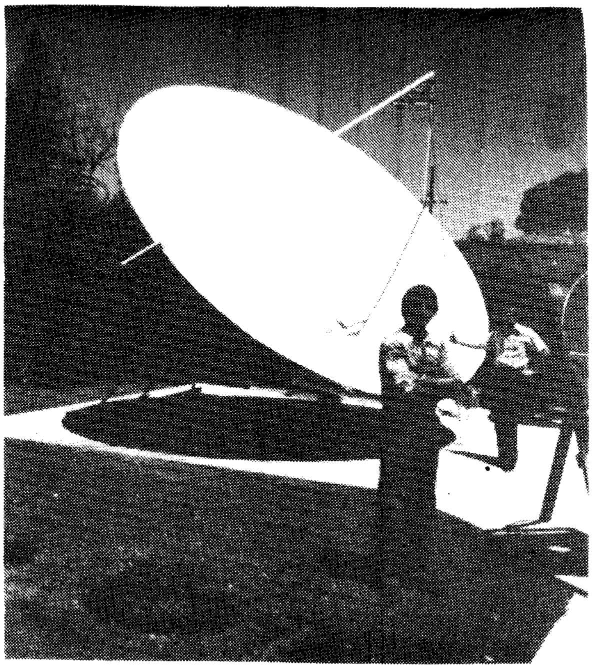
2)**Medium quality CATV** (cable TV system type) units - $600 to $800

3)**High quality CATV** (best performing professional units) - $1000 to $1800

If you are a careful shopper, you can locate a ten foot TVRO antenna with mount (the support mechanism that holds it in position) and the feed (the portion of the antenna that collects the signal from the reflector surface and where the LNA mounts) for say **$1800**. A 150 degree LNA will add another **$1100** to the total (now $2900). A good buy on a tuneable receiver will add another **$3000** (now $5,900). A MATV quality modulator will add **$600** and that brings us to $6,500 with**out** any special 'brother in law' deals. Another $500 at the outside for cables and concrete and twenty man hours of time and you will have a first class, all commercial equipment installation in operation. About the price of a new in-ground swimming pool of medium grade, only you can use the TVRO terminal all year long regardless of weather!

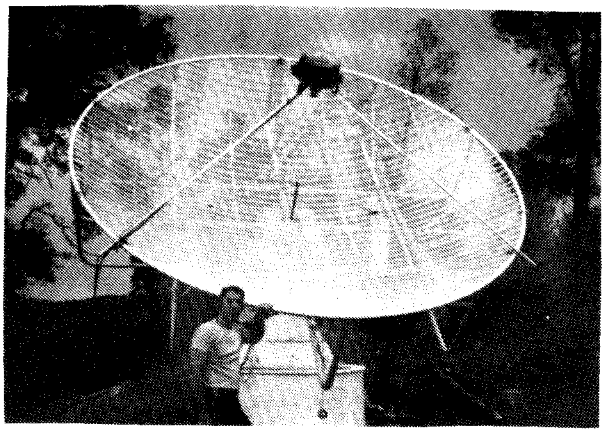
Still way over your budget? Well read on because now if you have good common sense and some familiarty with electronics (or know someone who has the experience), you can really start to save money.

This is the "I did **most** of it myself" approach. First you start with an antenna kit (see Kintech Technology in the reference section) which in the 12 foot version costs around $1200. This will require most of a weekend to assemble but all of the parts are there and what better way to spend a weekend! Besides, you just saved nearly $2000 in the process of putting it together yourself! (Note: other do-it-yourself antenna kits will undoubtedly become available, but at the time of this writing this is the only such kit available on the market.)



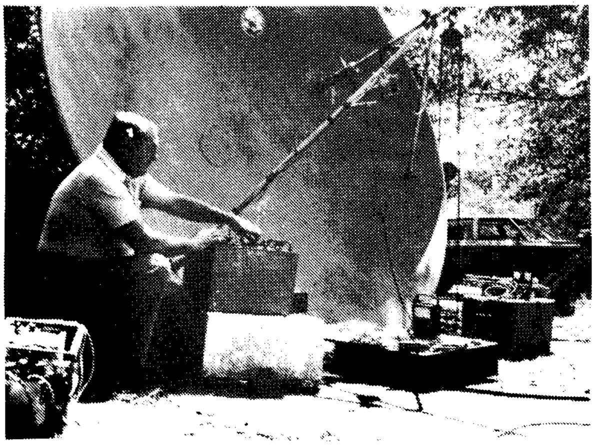
KINIK AND SHUCH - **John Kinik of KINTECH (foreground) and Paul Shuch of Microcomm (background) with the Kinik 16 foot do-it-yourself all aluminum antenna (kit) at Santa Clara, California lab of Shuch.**

TAYLOR HOWARD AND RECEIVER - **The Howard Terminal receiver is original and was designed from scratch from years of research work done by Howard.**



COOP AT HOWARD'S TERMINAL - **The Taylor Howard antenna is a 4.5 meter surplus military antenna covered with a screen mesh. With motor drives, Howard can change antenna elevation and azimuth by remote control.**

But wait . . . there is an even **less expensive** way to go! If you are a very cheap person who likes to dig around in musty corners pawing over old, discarded electronic equipment other people have thrown away, you can 'convert surplus electronic equipment' to receive satellite television. One of the "pioneers" in this area of activity is Robert Coleman of South Carolina. Coleman has gathered up bits and pieces from dis-carded electronic equipment (which he has purchased at electronic 'flea market' sales) and for well under $500 he has a complete 24 channel receiver system operating with a ten foot dish antenna that he found buried away in a junk yard. To help people duplicate in function his terminal, Robert Coleman has produced a step by step manual ("The Coleman TD-2 Conversion Manual") and it also is listed in the reference list.



COLEMAN'S UNDER $500 TERMINAL - **Robert Coleman of South Carolina has created, using surplus electronics equipment, his own version of a home terminal. Antenna is ten foot diameter; all electronics is outside, largely spread on ground, which he covers up with plastic sheet to keep water out!**

There. We've gone from over $10,000 to under $500 in just a vew short paragraphs. Truly, there is an option available for almost everyone interested in having a private satellite terminal in their yard!

THE ANTENNA

As you have surmised, the antenna is a very imporant portion of the total package. All of the commercial antennas, and, the Kintech Technology antenna 'kit'(s) follow the same general approach. They have a bowl-shaped (parabolic) "**dish**" (not **disc** . . . please!) which has a support mechanism that allows the antenna to point upwards at an angle, to 'catch' the incoming signals from the satellite which rests well above your horizon out there in near-space above the equator.

Then they have a small antenna called a 'feed' positioned (typically, but not always) out in front of the antenna at a point known as the 'focal spot'. To this small feed antenna is attached the LNA (low noise amplifier).

As noted, bigger is better if you are after weaker signals (i.e. live in a low dBw/EIRP area). Bigger costs more, is harder to install, and may reach the point where the antenna is larger than the house! Sometimes there is no substitute for big antennas; trying to receive the American 'domestic' satellites in Venezuela, for example, requires a very big antenna; the 33 foot (or larger) size to be precise.

A twenty foot antenna weighs in (with all parts) at near 3,000 pounds. A six foot weighs less than 100 pounds. In between the weights vary with type of construction, and construction materials (i.e. fiberglass is lighter than metal but not as much lighter as you might expect).

Antennas are often described by their mounting/tracking mechanisms. The mount holds the antenna up, in position and pointing the correct direction; the tracking system allows you to manually move the antenna from satellite to satellite.

1) **Polar mount** - a mechanical mounting system which when properly installed allows you to change antenna heading from satellite to satellite by merely adjusting in one 'plane' (the left/right plane or azimuth).

2) **Az-E1** (or E1-Az) **mount** - a less complex mounting system to build but more complex to use (in the field) because each satellite change requires two separate adjustments of the mount; one for left/right (azimuth) and another for up/down (elevation).

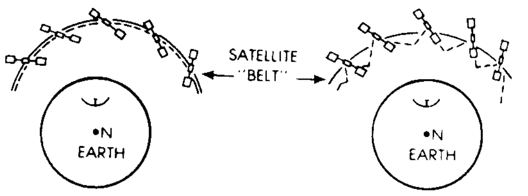
A few private terminal operators have developed remote, motor driven adjustment systems so that from the comfort of their TV viewing chair they can move the antenna from satellite to satellite. No economically priced system like this is presently available commercially however. Moving the antenna still requires going to the antenna, loosening some bolts and 'shoving' the antenna from one location to another for most users.

Because so much television exists on the most regularily scheduled program satellite, the RCA F1 'bird', most private terminal viewers simply place their antenna pointing at this satellite and sit back to enjoy the 19 or so channels available. If this sounds like sufficient television for you, the mount system can be designed so that once the antenna is positioned it is simply left in that spot. By eliminating either a 'tracking polar mount' or an Az-E1 mount mechanism, several hundred dollars can be shaved from the price of the antenna system.

If you are considering building your own antenna system, here are some guidelines. Commercial antennas work to a 20/1000ths design accuracy and they are installed to a 50/1000ths field accuracy. Deviations of less than 100/1000ths (0.1 of an inch) **across the antenna surface** (that's a plus and minus number) can be tolerated without losing antenna efficiency, but deviations much greater than that start playing havoc with the working efficiency of the antenna's reflector surface. This simply says that you cannot expect a poorly constructed antenna surface to deliver satisfactory results.

Recently another antenna option, for the do-it-yourself builder, has come along. A well known electronics experimenter in Arizona, Oliver Swan, has developed a novel antenna design known as a 'spherical' reflector. Basically, it looks like a 'billboard' from the front or side. Measuring ten feet on a side, it has a slight concave appearance with the center indented. The antenna frame is constructed from ordinary 'gas pipe' and it is surfaced (or covered) with ordinary aluminum window screening rather than a solid surface. Preliminary tests indicate the ten foot by ten foot

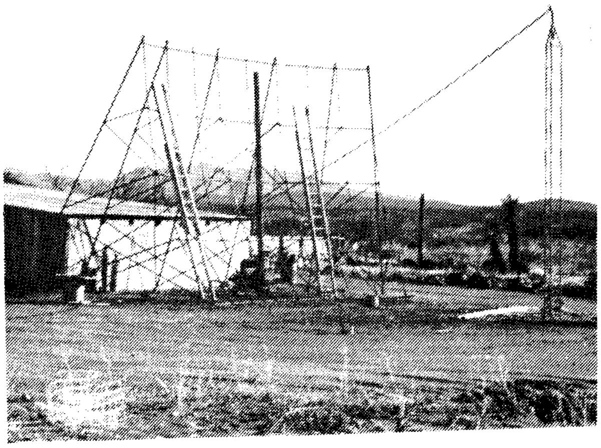
SATELLITE RECEIVE ANTENNA MOUNTS



POLAR MOUNT—TRACKS EVENLY LEFT TO RIGHT (OR RIGHT TO LEFT) IN "AZIMUTH" THRU SATELLITE "BELT"

AZ-EL MOUNT—TRACKS ACROSS "BELT" IN STEPS; REQUIRES SEPARATE ADJUSTMENTS FOR AZIMUTH (LEFT/RIGHT) AND ELEVATION (UP AND DOWN)

TWO TYPES OF ANTENNA MOUNTS - are available commonly. The polar mount is installed on a true north by south line and elevation (up and down) motion of antenna 'tracks' the satellite orbit 'automatically' when azimuth (left and right) is adjusted. Az-E1 mount system requires separate adjustments of elevation and azimuth adjustments to change satellites.



SWAN'S SPHERICAL FRAMEWORK - Innovative first effort with spherical antenna in Arizona by Oliver Swan (shown here prior to screening; this particular model is 20 feet by 20 feet). Swan's current model is 10 foot by 10 foot, uses aluminum window screen for surface; costs under $500 complete to duplicate.

size performs about as well as a 10 to 11 foot true parabolic antenna.

There are several advantages to the spherical antenna. One is construction ease since it is similar to building a 'fence' or a 'wall' on a building. Swan has simplified the task of creating the slight 'curve' in the surface to form the reflecting region, and this brings us to the second apparent advantage. Oliver reports the construction time is around 30 man hours and the total cost of materials around $300 to $400.

There is another advantage to the antenna; it can see several satellites at once **without moving** the reflector surface. By either moving the small feed antenna, or even installing two or more separate feed antennas, along a line parallel to the front of the antenna, the user 'changes satellites' by leaving the reflector surface in place and simply changing the 'focus point'. The reference list in the rear of this Handbook, includes a listing for a set of plans for this novel antenna system.

Commercial antenna suppliers are found in the rear references.

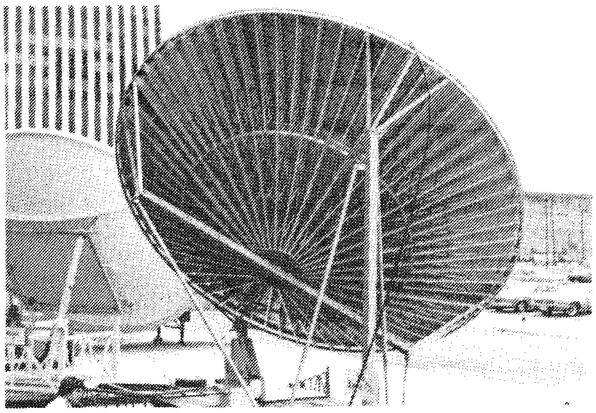
THE LOW NOISE AMPLIFIER

The LNA or low noise amplifier is perhaps the most critical segment of the typical system. The signal level from the satellite is so very weak that the ratio of picture (quality) or signal to interfering 'noise' is bordering on being impossible to use. The LNA makes it possible for this weak signal to be boosted in strength (amplified), and 'lifted' out of the noise to a level which the subsequent receiver can interrogate and turn into picture and sound voltages.

The LNA is rated by two important factors; **how much gain** it has (i.e. its ability to amplify the weak signal and by how much), and, of even greater importance, the amount of 'new noise' which it contributes to the noise already present. An amplifier with lots of (signal) gain is useless if it has lots of noise of its own.

So **more gain** is better; **less noise** is best. Ideally mankind would design an amplifier with lots of (controlled) gain, and no noise at all. Unfortunately that defies the laws of physics so we settle for as little noise as possible from the amplifier.

More gain means more transistor stages. Each stage consists of a transistor devie and the necessary parts that make it operate. In terms of what is acceptable, the typical **commercial** LNA devices have from 50 to 60 dB of gain. People who have built their own LNA systems report that gains of 30 to 35 dB seems adequate however and upon investigation it turns out that the "50 to 60 dB of gain" specification is a hold over from the days when TVRO terminals cost upwards of $125,000. So because each amplifier 'gain stage' costs money, it would seem that an LNA with sufficient stages to create say 35 dB of gain (this typically requires three good stages or four not quite so good stages) would be adequate for the private terminal system.



TWO TYPES OF DISH CONSTRUCTION - all aluminum 20 foot dish from USTC (right) is constructed like a tank with many braces and cross section pieces; smaller 5 meter fiberglass dish of AFC (left) is in three sections.

Less noise means a higher grade or caliber of transistor in the first gain stages of the LNA. Just one year ago, the individual transistors utilized in the first two gain stages of a typical commercial LNA **cost the manufacturer** of the LNA over $300 **each**! Fortunately times have changed and these same transistors now cost under $100 each. That's still not cheap, but it is better by a factor of 3 and perhaps in another year they will come down as much again. As recently as April of 1979, virtually no private terminal "build it yourself" types would attempt to build their own LNA; it seemed beyond 'kitchen table construction' technology. More recently, however, people such as Robert Coleman (the chap with the under $500 terminal) have shown that a person with a good electronics background can build LNAs that work about as well as the commercial units for approximately the cost of the transistors alone since there isn't much else in a **basic** LNA but the expensive transistors. This all says that as volume production of the parts that go into an LNA progresses, prices for this still quite expensive portion of the typical terminal will drop again and substantially.

For most systems (i.e. commercial and private) an LNA unit in the $1000 to $1200 price range will do the job. The proper choice of an LNA is a hard engineering kind of decision. You must weigh the **signal level present** (the EIRP or dBw contour found on the maps previously referenced), the **antenna size** (in terms of the gain the antenna has), and the **noise factor of the LNA** in choosing the exact LNA required to produce perfect pictures with the other parameters fixed. You can't get too good an LNA, but if you over-buy the LNA (by purchasing one that is better than required), you'll probably not know the difference since once a picture is perfect (i.e. all of the noise is gone) beyond that point you can't tell (with the eye) when the picture gets better. **Perfect is perfect.** At the risk of oversimplifying the decision process, here is one approach to selecting the LNA when you **(1)**know the signal contour your are located within, and **(2)** have decided upon antenna size that you can live with:

Signal Contour	Antenna Size	LNA Required
36/37 dBw	20 foot	250 K
	15/16'	170 K
	12/13'	150 K
	10 foot	120 K
	8 foot	100 K
34/35 dBw	20 foot	170 K
	15/16'	150 K
	12/13'	120 K
	10'	100 K
32/33 dBw	20'	150 K
	15/16'	120 K
	12/13'	100 K

What does all of this mean? An LNA is rated or graded by its noise contribution. In scientific measurement circles, an amplifier is tested or measured on a 'temperature scale' known as the Kelvin (or K) scale. A noisefree amplifier would have a 'noise temperature' of 0 degrees K(elvin). Therefore, less degrees K of noise is better (i.e. higher K is worse). With 1979 technology, the best transistors available are capable of producing amplifier systems with around 90 to 100 degrees K of noise. Perhaps as amplifier/transistor technology improves there will be even lower noise amplifiers available; which as you can see will change the parameters of what size antenna you can use in a given dBw signal contour area.

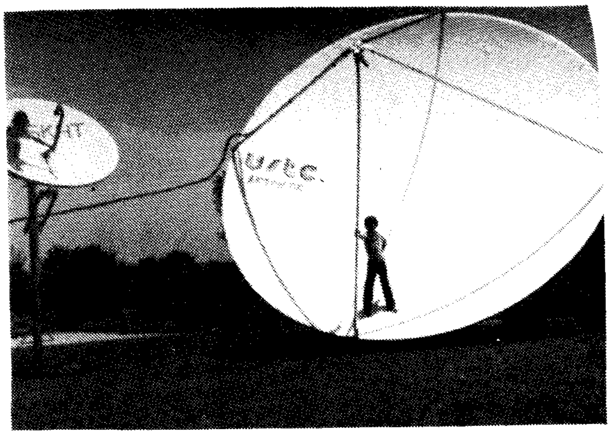
The LNA must be powered by an operating voltage. There are two options. It can be powered from standard household current (110/120 volts AC), or through a special power supply that provides between 12 and 18 volts of DC (DC is the same type of voltage you obtain from a battery). Many of the commercial receivers now have an 'LNA powering jack' located on them to allow you to plug the LNA power line into the receiver proper and operate from a 12 to 18 volt DC source. Experience has shown that powering an LNA diriectly from a standard 110 volt (AC) wall plug is a mistake for many reasons.

The LNA mounts at a special (designated by the antenna designer) spot on the antenna. With some antennas (so-called 'prime focus feed') this point is known as the 'focal point'; that location out in front of the antenna where all of the energy intercepted from or by the curved parabolic surface focuses to. Other antennas employ a different technique called a Cassegrain feed which results in the LNA being placed behind the dish surface proper connected to a collector that pokes through the surface of the dish antenna at a small 'sub reflector' mounted out at the *focal point.* Both systems have proven very satisfactory.

THE COAXIAL CABLE LINK

Connecting the LNA to the receiver is a job for a relatively special 'coaxial cable' commonly found in elaborate two-way communication systems. This job is done with a cable that is capable of carrying these super-high-frequency signals without severely degrading (attenuating) them. Remember how weak the signals are before they are amplified by the LNA? Well, regular coaxial cable (such as that used by CB or ham radio enthusiasts) is **not** adequate! The **proper cable** is air dielectric (or insulated) 1/2 inch diameter coaxial cable known as Heliax for runs of up to 50 feet between the LNA and the receiver; or 7/8ths inch cable of the same family for runs up to several hundred feet in length.

Most cable suppliers will precut the cable to the exact length you require, and also place onto each end of the cable the special connectors required. Calculate (measure) how much you require to run from the LNA down the antenna supports to the ground and then to the receiver location proper. Order just that amount, putting (or ordering) female 'type N' connectors on both ends. Then use a short length (1 to 2 feet) of RG-214 A/U to 'jumper' from each end of the air dielectric cable to **(1)** the LNA output fitting at the outdoor end, and, **(2)** the input to the receiver proper at the indoor end. **Never** plug the (physically) heavy 1/2 or 7/8 inch line directly into the coaxial connectors mounted on either the LNA or the receiver as the sheer weight of the line will (sooner or later) snap off the fittings!



BIG AND LITTLE OF IT - 'Tiny' six foot antenna (left) was extensively tested at Coop's Lab along side larger twenty foot (right). Even equipped with very best 'state-of-the-art' electronics, six foot produced somewhat noisy pictures.

You can, with the proper choice of LNA (choice being a function of gain here) operate several receivers from a single antenna/LNA. A device known in the trade as a 'signal divider' is installed at the indoor end of the air dielectric line, and it splits up the available signal voltage to feed two or more receivers simultaneously. Firms manufacturing such devices are listed in the reference section of this Handbook.

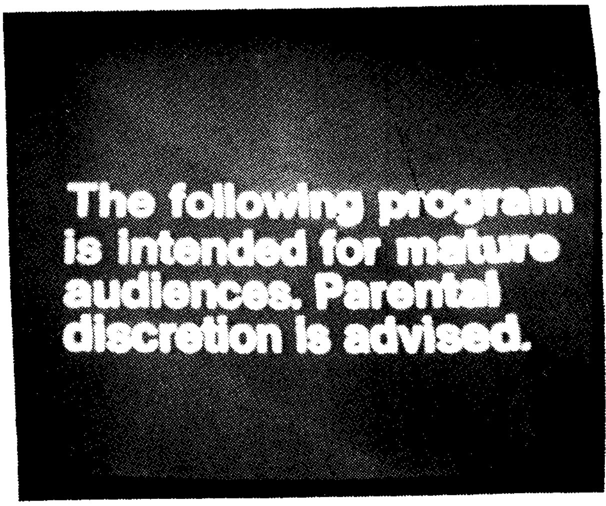
THE RECEIVER

To the neophyte, the receiver may seem like the only 'special part' required. Many people have asked whether a 'simple antenna' might not be installed on the house, and a 'converter unit' installed to convert (or change) the frequency of the satellite signals to a frequency that can be 'tuned in' by a standard TV receiver. As you have seen, a 'simple antenna' is not so simple after all. And the LNA is not your ordinary TV antenna 'signal booster'. As for 'converting' (or translating) the satellite 3.7 to 4.2 GHz frequency band down to say the UHF channels on your TV set, well . . . the satellite signals are FM (frequency modulation) while your normal TV signals are AM (amplitude modulation) and this makes the scheme impactical. On top of this, the 'width' of a satellite TV channel is as wide as **six** standard TV channels, which simply means it won't 'fit' into the innards of a standard TV set without some major surgery.

Receivers, like every other major component part of this system, are in a rapidly changing world of technology. The first receivers sold to the cable industry came directly out of the catalogs of firms supplying equipment to the large, fancy Intelsat station terminals. With a price tag to match; $10,000 for the receiver alone was not uncommon in 1975 and early 1976. The volume production offered by cable TV (one firm, Scientific Atlanta, is now **up** to a production run of 500 receiver units per month) provided the impetus for receiver designers to go back into the originally-for-Intelsat designs and start over. Cable satellite receivers have different requirements than Intelsat and by 1978 cable's unique needs were being met by numerous suppliers. It has only been since this summer, however, that receivers have been available in relatively good supply; typical 'turn around' now being 30 days from receipt of order or so.

CATV systems require two different types of receivers. Most CATV receivers are single channel only; that is, they come from the factory 'dedicated' to a single transponder/channel. This makes sense for cable since they install one satellite receiver per satellite program channel carried by the cable system, and leave that receiver on that channel full time. Most of the present 'single channel' receivers can be 'field retuned' to a different channel, but not quickly. It takes a few minutes with a screwdriver and in some cases a test meter to transfer the 'single channel' from one (dedicated) channel to another dedicated channel. This simply says that the single channel receiver is probably not what a private terminal viewer would most like to have since 'tuning around' the full range of channels is a time consuming process and may require some technical expertise. Single channel receivers are commonly available now, and sell in the $2,200 to $3200 range.

The other type of receiver is tuneable. That means that it has either a 'tuning knob', a set of tuning push-buttons, or a series of 'step switches' which are manipulated to tune through the full range of channels. There is some confusion as to whether these tuneable receivers are "12 channel tuneable" or "24 channel tuneable". Recall that WESTAR and ANIK are 12 channel satellites using horizontal (only) polarization, while SATCOM and COMSTAR are 24 channel using both horizontal and vertical polarization. And that SATCOM and COMSTAR get 24 channels out of the available frequency space by **re-using** the same 'channel width' two times; once on each polarization. This simply says that a 12 channel receiver **capable of tuning** the full spectrum width for 12 channels will also tune the full 24 channels since you only tune in one group of 12 at a time, and both are within the same spectrum width. The separation between the horizontal 12 and the vertical 12 is done with the antenna (feed) polarization, not the receiver proper.


The following program is intended for mature audiences. Parental discretion is advised.

GP, R BUT NO 'X' - to date movies shown via satellite have been complete, unedited just as seen in theaters. Warnings for GP and R movies appear ahead of movies for counsel in family viewing. X movie fare has not yet been shown although some R rated fare is certainly borderline!

A highly competitive environment has forced receiver manufacturers to keep their noses to the grind stone. The more-desirable-for-private-terminal-viewers tuneable receivers have dropped from a minimum price of around $5,500 in mid 1978 to under $3,000 today and there are indications that a $2,000 tuneable receiver is not that far away.

Through all of these changes runs the thread of mass production. When it comes, the receiver should become $500 box. But it may be several years getting there. In the interim, commercial receivers will continue to drop in price, a step at a time, and people with some technical savvy will follow the Microcomm, or Howard or Coleman approach and assemble their own for what will eventually be the mass production retail price range of $500 or a tad more.

AFTER THE RECEIVER

As noted previously, the receiver does not have a built-in picture tube nor a speaker. Yes, the receiver of the future probably will, but that's down the road aways since these additions would greatly increase the size of the box and the price. And in truth, you don't need to add this additional cost since you have a 'handy' display system already in your home; your TV set.

The present generation of commercial receivers give you a video and an audio output. The audio could plug directly into a speaker or your home sound system. It is ready to go. But the video needs some additional processing before you can see it. The cable firms don't **look at** the picture at this point; they "reconvert" it to a TV channel using the TV channel 'modulator' device. The modulator is simply a low power (very low power) TV transmitter, just like (in function) the local TV station operates. It has a jack to plug in the picture (video) coming from the TVRO receiver, and a second jack to plug in the sound (audio). It combines these two separate signals and creates a 'composite TV signal' that comes out of the modulator box on a TV channel (i.e. channel 3). You plug your TV receiver(s) into the modulator output, tune the TV receiver to the channel that corresponds to the TV modulator channel, and sit back and enjoy the satellite reception.

The cable TV 'modulator' starts out around $275 and goes all the way up to nearly $2,000. In general, more dollars mean more features and to some extent better looking pictures; although once you pass the $800 plateau you are just about at the end of the quality line. There are other ways to get the TVRO receiver video and audio into your TV receiver, in a pinch, for perhaps less money. If you own a home videotape machine (Beta or VHS format) you probably have noticed that on the back apron there is a jack for a 'TV camera' and 'audio' **input**. The home VTR **includes a low power modulator**; that's how the TV taped programs get from the tape to your TV set. Typically operating on TV channel 3 or 4 (with a switch on most units to select the proper output channel), when you watch a home VTR in your home you are really watching a picture generated in a low power TV channel modulator. If you go from the TVRO receiver output jack to the VTR "Audio In" jack you have just connected up the VTR so **it acts as a modulator** for your TVRO signals. Switch the VTR to "camera input" and turn on the VTR. Now you can watch the TVRO pictures through your VTR "modulator" on the same channel you normally watch the VTR.

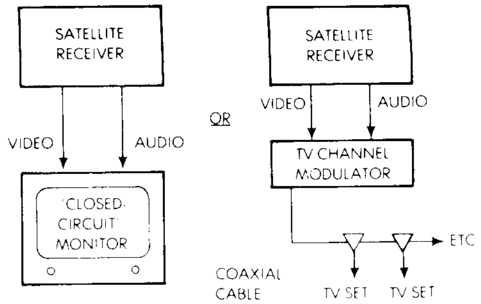
The tiny 'modulator' found inside of the home VTR is a popular 'gadget' in many electronic magazines (i.e. **RADIO ELECTRONICS, POPULAR ELECTRONICS**, etc.). They are both 'sold' as kits and completed units ($25 to $75) and detailed as construction articles. If you are going to purchase a CATV grade unit, and you want **professional** results, here are some guidelines:

1) **Price range:** $500 to $800
2) 75 ohm video input
3) 600 ohm audio input
4) separate, front or rear panel, controls to adjust (video) modulation index, percentage and audio modulation percentage
5) A meter or light to indicate when you are properly adjusting the video and audio modulation controls
6) A vestigial sideband filter

SHARING THE SATELLITE SERVICE

As noted previously, the satellite service can be 'shared' quite inexpensively once the terminal itself is in and operating. The output (TV channel) from the modulator is sufficiently strong that you **could** plug in 1,000 feet or more of low cost RG-59/U or RG-11/U coaxial cable and carry the signal around the neighborhood. Running the cable down back lot lines, under ground, or in some manner to keep it out of harm's way, you can cover quite a bit of territory for around a dime a foot. As the distribution (coaxial) cable passed by each home you wished to 'serve' a small

PICTURE VIEWING OPTIONS



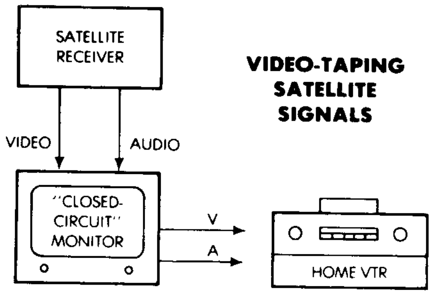
SIGNAL DIRECT FROM SATELLITE - can be viewed directly on a closed-circuit box known as a 'video monitor' which produces extremely high quality reproduction, akin to that seen in TV network control rooms. This is fine for 'local viewing' at the receiver site, but most common alternative is to employ TV channel 'modulator' to re-convert the satellite signal back to a standard TV channel for viewing on standard TV receivers.

MATV/CATV type device known as a 'signal' tap' is inserted into the line and a small amount of the signal present is 'tapped off' for a branch line that would run on into that home. This is basically what a cable TV system does. If 1,000 feet or so of cable is not enough for your needs, for around $50 you can buy a 'repeater amplifier' or 'line amplifier' that will boost the signal up to go another 700 feet or so. And repeat the process several more times if required.

How to design a distribution system is beyond the scope of this Handbook; but dealers and distributors who sell master antenna (MATV) and community antenna (CATV) products have guidebooks and data sheets to help. Remember, however, that the FCC considers any such system with 50 or more homes connected a 'cable TV system' and this brings added regulatory problems.

Can you string the distribution cable on the telephone poles in your neighborhood? Yes but only after obtaining the permission of the utility company. They typically will **rent** 'space' to you for this, but it will be a long, involved process requiring a battery of attorneys and lot's of your time and at that you will pay an annual rental fee that may reach as much as $10. per pole 'contacted' per year. You are really better off staying away from the utility poles.

In a previous section we touched on the matter of videotaping the programs seen and 'sharing' in this manner. The bottom line is that **any** videotaping of somebody else's program material is probably an infringement of their copyright. The court's are wrestling with this problem now (Walt Disney Studios and others are suing Sony in a landmark case not yet decided) and any decision is bound to be appealed. Videotaping programming that has been released to the **general public** through **regular** television stations is one aspect of the question; videotaping programs released to the program service is an entirely different question. Everyone pretty much agrees that as long as common carrier broadcasts are considered 'private' (as opposed to public), that anyone **legally entitled to** receive those broadcasts (either directly from the satellite, or via satellite through a local cable service) probably is permitted to videotape the programs for his **own private use**, but when that person begins to share the videotapes, he may be entering into an entirely different area of law.



VIDEO TAPING OF SATELLITE SIGNAL - Is perhaps simplest approach to 'sharing' of the satellite service although there are many legal problems with taping a 'product' that belongs to someone else. Video and audio outputs from TVRO receiver are simply looped to the inputs of the home VTR (video and audio in). While program is being taped in this format, viewer can simultaneously view picture through TV channel modulator output from VTR.

The premium program suppliers on satellite (HBO, SHOWTIME, FANFARE, STAR CHANNEL, HTN) are basically middle-men. They don't own the rights to very much of what they show (in HTN and STAR Channel's case they own none of it presently) and while they are 'using' (under contract) other people/firm's products, they are supposed to see that there is no 'unauthorized use' of the material. The truth is that in virtually any major city where there is HBO or SHOWTIME (etc.) service available, via cable, MDS or otherwise, a person can purchase VTR tapes of the current HBO (etc.) fare through numerous 'dealers' within twenty four hours of the time the program appears. Several firms operating in the State of Florida provide an estimated thousands of tape dubs of HBO (etc.) programs to people owning videotape machines in the islands of the Caribbean and throughout South America on a commercial (although illegal) basis.

THREE RELIGIOUS CHANNELS - CBN (Christian Broadcasting Network, Virginia Beach, Va.) is one of three twenty four hour per day religiously programmed channels on SATCOM FI.

The author recently visited several remote islands in the Caribbean where he found VHS format machines in private homes with stacks (dozens and dozens) of current-month HBO program tapes piled up. One Miami firm offers to supply a four hour VHS tape with new programming on it each day (HBO fare typically) for $100 per week (the tapes are returned to the Miami firm for new material weekly). All of this illustrates that while unauthorized reception **from the satellite** may be of concern to the program suppliers, the proliferation of VHS and Beta format machines throughout the world has created a much greater 'security problem' for them than they are willing to admit.

FREQUENTLY ASKED QUESTIONS

Here are some of the more frequently asked questions coming from people who have read various magazine articles concerning satellite TV reception.

a)"**What about the Japanese? Don't they have a complete home TVRO terminal for $500? Can't I buy one of these?**"

The Japanese are experimenting with a new type of **experimental** satellite that **is** specifically designed for direct-to-the-home broadcasting. It has two channels of television maximum capacity. The Japanese government has funded the experimen which includes the development of low cost receive terminals. At the present time, these terminals are **not** available in the United States and even if they were they do **not** operate in the American satellite frequency band. They would, therefore, be of no use to a U.S. viewer and reception in North America of the Japanese satellite is not practical because of its location far to the west of us.

b)"**The Japanese terminals use a very small, 2 foot, antenna. Why can't we use this size antenna here?**"

They get away with a small antenna because of two reasons; their satellite is much more powerful than ours (200 watts transmitter versus our five watts), and, because their experimental satellite operates on a high frequency band (11.7 to 12.2 GHz). At this higher frequency, their small 2 foot antenna has about as much signal-grabbing power as a 6 foot does at our 3.7 to 4.2 GHz frequency band.

c)"**I am interested in building a terminal using surplus equipment. Can you help me find a surplus parabolic antenna and the TD-2 receiver unit which Robert Coleman used to build his low cost terminal?**"

Sorry. We are not in surplus equipment business and frankly the availability of surplus equipment means equipment that is disposed of by the government or by large communication firms (such as the telephone company) in large lots. This is typically done through people or firms who bid on the full 'lot of equipment' being disposed of, and then they in turn select out the pieces they can make the most money reselling and 'junk' the rest at a local junk yard. Many amateur radio publications (73 Magazine in particular) carry advertising from surplus outlets.

d)"**Locally we have HBO via some special transmitter system that goes to apartments, hotels and some businesses. How can I get into this circuit?**"

First of all, that system is known as 'MDS' for Multi-Point Distribution (Service). The best way to get into the circuit is to call up the company in your area offering the service and ordering it. Typical charges are $150 installation/equipment deposit and $10 to $15 per month. The August (1979) issue of **73** Magazine carries a detailed article on building equipment for this service.

e)"**Can I reach Bob Cooper on the telephone to discuss my planned terminal?**

That is simply not practical. Because of the widespread publicity in print and on television concerning his work it is not uncommon for over 100 telephone calls per day to be received at the Coopers. Between preparing the various manuals that are available, creating new weekly television programs, producing new videotapes on additional aspects of this subject, staging the 'Satellite Seminars' now going on throughout the country and working on additional magazine articles and books he is committed to do, there is simply no time for him to give personal assistance on the telephone. If you do have a serious question, or suggestion, we suggest you write it down and send it along to the primary mail service address: P. O. Box G, Arcadia, Oklahoma 73007

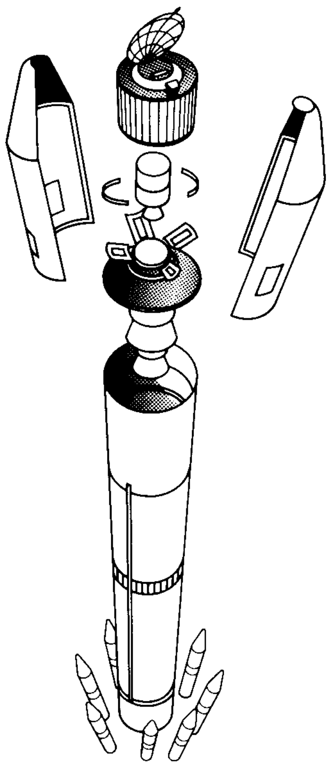
……

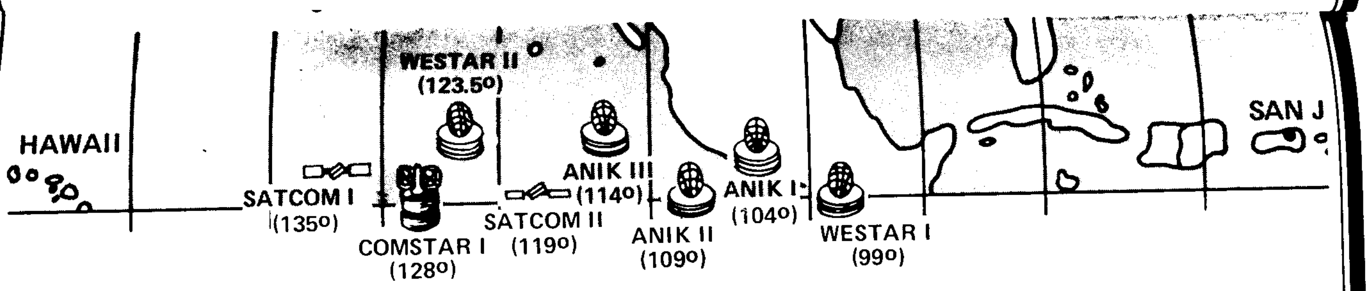
THE SATELLITES AND LOCATIONS

The satellite locations are known in reference to the prime or 0 degree meridian which runs north and south through Greenwich, England. There latitude (north or south of the equator) is essentially 0 since they are directly overhead. As you will see, most of the U. S. and Canadian satellites are located south or southwest of the U.S. proper.

RCA F1 (presently located 135 degrees west; will be 136 degrees west after launch of FIII late in 1979)

Program Service	**Transponder**
KTVU (San Francisco)	1
PTL (Praise The Lord)	2
WGN (chicago)	3
out of service	4
STAR CHANNEL	5
WTCG (Atlanta)	6
ESP (New England area sports	7
CBN (Christian Broadcasting Network)	8
C-SPAN (Congressioal coverage, live)	9
MSGE (Madison Square Garden Sports)	
SHOWTIME (west coast)	10
Nickelodeon (Children's TV network)	11
STAR Channel (after 11 PM eastern)	
SHOWTIME (east coast)	12
KTBN (Trinity Broadcasting)	13
out of service temporarily	14
reserved for RCA telephone, data	15
FANFARE (southwestern sporting events)	16
WOR (New York)	17
Reuter's New Service (digital, not video)	18
reserved for RCA telephone, data	19
HBO reserve, various occasional programs	20
SPN (Satellite Program Network)	21
HBO (west)	22
Take-2 (HBO 'family service')	23
HBO (east)	24





RCA FII (located 119 degrees west)

Note: This satellite carries very little 'regularily scheduled programming' although it does carry significant amounts on 'occasional video programming'. The two most significant 'regular' users are:

8 NBC intra-network feeds including Johnny Carson show
23 Alaskan 'Bush Terminal' video

Other transponders that frequently carry video include 4, 16, 17, 18, 20 and 22.

Note: On all RCA satellites, the even numbered transponders (2, 4, 6, etc.) are horizontal while the odd numbered transponders (1, 3, 5, etc.) are vertical.

RCA FIII (scheduled for opration from 132 degrees west late 1979, early 1980)

Note: When launched, all cable television programming now on FI will transfer to FIII and new (additional) cable programming will appear on FI.

WESTAR I (located 99 degrees west)

1,2,6	Occasional video
8	PBS network video
9	PBS network video
11	PBS network video
12	PBS network video and occasional video

WESTAR II (located 123.5 degrees west)

1,4,12 occasional video

Note: It is possible that Los Angeles KTTV and New York WOR may begin regular use of these transponders during the fall of 1979. WOR is already available on transponder 17 of SATCOM FI.

7 SIN (Spanish International Network)

WESTAR III (91 degrees west)

Note: Western Union's WESTAR III satellite scheduled for launch mid August (1979). When operational (about 90 days after launch) it will carry some video programming but the format has not been decided at presstime for this edition of the Handbook.

ANIK III (114 degrees west)

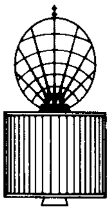
4	Occasional CBC pre-network feed video
8	CBC French (network) television
10	CBC English (network) television
12	CBC English (northern) television

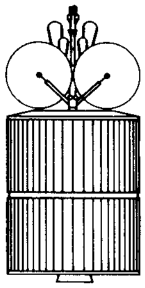
ANIK B (109 degrees west)

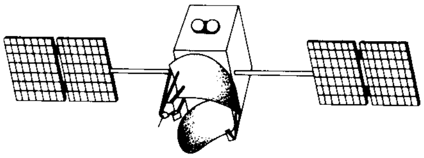
Note: This new Canadian satellite may ultimately be the home for the video services now found on ANIK III (prior listing). Canadian cable companies are negotiating to bring programming to the satellite similar in concept to the programming now found on RCA FI, for Canadian cable viewers. This satellite has a more powerful transmitter than other 3.7 to 4.2 GHz range satellites now operating (10 watts versus 5) and when in regular use should allow quality reception with 6 to 8 foot dishes in the **center** of its coverage area in Canada. This satellite is also equipped to experiment with the 11.7 to 12.2 GHz downlink frequency range.

COMSTAR

There are three operating COMSTAR satellites (at 128, 95 and 87 degrees west) which have been precluded from engaging in video relay. However, that prohibition is expected to end before 1979 is over and at that time these 24 channel satellites can be expected to become quite active with video program relay.


Anik A-III


Intelsat IV


Anik B

CBC NORTHERN SERVICE

CBC NORTHERN TV SERVICE SCHEDULE

MONDAY

CHANNEL B (EAST)		CHANNEL C (WEST)
8:15 a.m.	OPENING OF TRANSMISSION	11:15 a.m.
8:30	BONJOUR BONJOUR/FRIENDLY GIANT	
	FRIENDLY GIANT/BONJOUR BONJOUR	11:30
	IN TOUCH (PU VANCOUVER) Daily current affairs talk show from Toronto hosted by June Callwood	12:00
9:00	ALBERTA SCHOOLS Clue by Clue: Case of the Touching Problem Animal Homes: At Home, Between the Tides	1:00 p.m.
9:30	MR. DRESSUP	1:30
10:00	SESAME STREET	2:00

11:00	BOB MCLEAN SHOW	3:00
11:55	NEWS	3:55
12:03	THE CONSUMER GAME "Something for a Rainy Day": A look at the many ways of saving money... different types of bank accounts, savings bonds and investments, as well as insurance protection. Alex gets a lesson on all this from his uncle and cousin who is an insurance agent.	4:03
12:15	GUESS WHAT Among the over one thousand inventions of Thomas Alva Edison, was the phonograph, the predecessor of today's stereo systems. Host Jan Rubes tells us how it all came about.	4:15
12:33	IN QUESTION Wayne Grigsby is the host for this program in which the studio audience is the show. Accompanied by the guest of the week, he circulates through the audience inviting a free interchange of ideas... with hings that provoke, puzzle, entertain or anger.	4:33
1:03	RYAN'S HOPE	5:03
1:30	THE EDGE OF NIGHT	5:30
2:00	TAKE THIRTY	6:00
2:30	CELEBRITY COOKS	6:30
3:00	THE STATIONARY ARK: ORANGUTANS	7:00
3:30	MR. DRESSUP	7:30
4:00	TRAVELS AND ADVENTURES	8:00
4:30	ALL IN THE FAMILY	8:30
5:00	HERE AND NOW(EX:ST.JOHN'S) An hour of news, weather, sports and public affairs	
	HOURGLASS (EX:VANCOUVER) An hour of news, weather, sports and public affairs hosted by Fred Latremouille.	9:00
6:00	THE MARY TYLER MOORE SHOW	10:00
6:30	THE CAMERA AND THE SONG "Come to the Tea": The Fivepenny Piece is a group of musicians, popular in Northern England. They sing about Stalybridge, the town in which they live, once the center of the nineteenth century cotton industry.	10:30
7:00	M*A*S*H	11:00
7:30	FRONT PAGE CHALLENGE	11:30

8:00	SUPERSPECIAL: BARRY MANILOW	12:00
9:00	NEWS MAGAZINE	1:00 a.m.
9:30	MAN ALIVE: LOVE OF LIFE	1:30
10:00	THE NATIONAL	2:00
10:22	NIGHT FINAL (EX:ST.JOHN'S)	
	NIGHT FINAL (EX:VANCOUVER)	2:22
10:35	90 MINUTES LIVE	2:35

CBC NORTHERN SERVICE

PROGRAM SCHEDULE

8:00 p.m. Mobile Showcase presents EDWARD TH
Years Of Waiting' The turn of the
momentous period for Edward...Brit
in the Boer War, Edward's disillus
mistress Daisy, an assassination a
lack of confidence in his ability.

9:00 p.m. 42ND ANNUAL NIT CHAMPIONSHIP GAME
Square Garden.

11:00 p.m. HOGAN'S HEROES #6706 'Cassanova Kl

11:30 p.m. MOVIE 17: Hell Drivers Speed-mad
hurtling down world's deadliest ro
of steel riding behind. Peggy Cum
Stanley Baker. 1958. Dra.

1:30 a.m. PLAYHOUSE 17: The Killer That Sta
Husband steals diamonds wife smugg
Unknown to both, wife carries plag
Charles Korvin. 1950. Dra/Mys.

3:10 a.m. NEWS UPDATE WITH BILL TUSH

3:30 a.m. PLAYHOUSE 17: Pirates Of Tripoli
engages pirates from Tripoli to he
hordes invade her kingdom. Paul H
Paul Newland, Patricia Medina. 195

5:10 a.m. DRAGNET #28815 'The Senior Citizen

17 WTCG Atlanta

1018 W. PEACHTREE ST., N.W.
ATLANTA, GEORGIA 30309

5:40 a.m.	WORLD AT LARGE	(C)
6:10 a.m.	NEWS UPDATE	(C)
6:30 a.m.	ROMPER ROOM #135	(C)
7:00 a.m.	THREE STOOGES/LITTLE RASCALS	
8:00 a.m.	LEAVE IT TO BEAVER #962A 'Beaver's Pigeons'	
8:30 a.m.	HAZEL #132 'Hazel Needs A Car'	(C)
9:00 a.m.	THE LUCY SHOW #45 'Lucy Teaches Ethel Merman To Sing	(C)
9:30 a.m.	GREEN ACRES #33 'Wings Over Hooterville'	(C)
10:00 a.m.	MOVIE 17: Tight Spot Woman convict is taken from prison to hotel by police in effort to maker her testify against gangleader. Edward G. Robinson, Ginger Rogers, Brian Keith. 1955. Dra.	
11:55 a.m.	NEWS UPDATE	(C)
12 noon	LOVE AMERICAN STYLE #651 'The Hairy Excuse'	(C)
12:30 p.m.	MOVIE 17: The Bottom Of The Bottle When alcoholic younger brother shows up, successful attorney worried about reputation, introduces him as a friend. Van Johnson, Joseph Cotten, Ruth Roman. 1956. Dra.	(C)
2:25 p.m.	NEWS UPDATE	(C)
2:30 p.m.	I LOVE LUCY #54 'Ricky Has Labor Pains'	
3:00 p.m.	SPEED RACER #12	(C)
3:30 p.m.	THE FLINTSTONES	(C)
4:00 p.m.	SPACE GIANTS #38 'Explosion'	(C)
4:30 p.m.	GILLIGAN'S ISLAND #1044 'Agonized Labor'	(C)
5:00 p.m.	I DREAM OF JEANNIE #102 'Ride 'Em Astronaut'	(C)
5:30 p.m.	BEVERLY HILLBILLIES #16 'Back To Californny' Part 4	
6:00 p.m.	ANDY GRIFFITH #46 'The Keeper Of The Flame'	
6:30 p.m.	MY THREE SONS #6531 'Hunk Of Hardware'	
7:00 p.m.	CAROL BURNETT & FRIENDS #707 Jack Weston	(C)
7:30 p.m.	SANFORD & SON #105 'A Matter Of Life And Breath'	(C)
8:00 p.m.	MISSION IMPOSSIBLE #152 'Break' Carl Betz and Barbara Anderson, and Robert Conrad are the guest stars as Jim Phelps takes in the guise of a hot-shot pool hustler to break up a gambling operation.	

PTL CLUB

PTL TELEVISION NETWORK

CHARLOTTE, NORTH CAROLINA 28279

	MONDAY	TUESDAY	WEDNESDAY
6:00	PTL CLUB	PTL CLUB	PTL CLUB
6:30	"	"	"
7:00	"	"	"
7:30	"	"	"
8:00	PTL TEACHING	PTL TEACHING	PTL TEACHING
8:30	TURNEY FAMILY	LAVERNE TRIPP	SOUND OF THE SPIRIT
9:00	GERALD DERSTINE	VICKI JAMISON SPECIALS	THE EXCITING LIFE
9:30	"	"	DAVID LOMBARDI
10:00	PTL MUSIC	PTL MUSIC	PTL MUSIC
10:30	"	"	"
11:00	PTL CLUB	PTL CLUB	PTL CLUB
11:30	"	"	"
12:00N	"	"	"
12:30	"	"	"
1:00	TEACHING	TEACHING	TEACHING
1:30	MARILYN HICKEY	ALMA DAVIS	LOU HILDRETH
2:00	HOLY SPIRIT NOW	HOLY SPIRIT NOW	HOLY SPIRIT NOW
2:30	"	"	"
3:00	"	"	"
3:30	REVIVAL FIRE	HAPPY HUNTERS	LESTER SUMERALL
4:00	GUIDELINE	FAITH FOR MIRACLES	CHICAGOLAND
4:30	"	"	"
5:00	DAVEY & GOLIATH STORYLINE	DAVEY & GOLIATH STORYLINE	DAVEY & GOLIATH STORYLINE
5:30	ADVENTURE CLUB	LET THE SON SHINE	KIDS
6:00	PTL MUSIC	PTL MUSIC	PTL MUSIC
6:30	"	"	"
7:00		LAVERNE TRIPP	CHICO HOLIDAY
7:30	HOUR OF POWER	HIGH ADVENTURE	REX HUMBARD
8:00	"	ORAL ROBERTS	"
8:30	INSIGHT	INSIGHT	INSIGHT
9:00	PTL CLUB	PTL CLUB	PTL CLUB
9:30	"	"	"
10:00	"	"	"
10:30	"	"	"
11:00	TEACHING	TEACHING	TEACHING
11:30	CALVARY TEMPLE	CHANGED LIVES	RALPH WILLIAMS
12:00	"	FESTIVAL OF PRAISE	SOUND OF THE SPIRIT
12:30	HOUR OF POWER	HIGH ADVENTURE	REX HUMBARD
1:00	"	ORAL ROBERTS	"
1:30	INSIGHT	INSIGHT	INSIGHT
2:00	PTL CLUB	PTL CLUB	PTL CLUB
2:30	"	"	"
3:00	"	"	"
3:30	"	"	"
4:00	TEACHING	TEACHING	TEACHING
4:30	CALVARY TEMPLE	CHANGED LIVES	RALPH WILKERSON
5:00	"	FESTIVAL OF PRAISE	SOUND OF THE SPIRIT
5:30	DWAINE FRIEND	GOD'S COUNTRY	CHRISTOPHER CLOSE-UP

BO
OFFICE
MBE
STAR CHANNEL
JUNE
SHOWT
NOVEMBE

FANFARE
AU
Carl Reiner's
"Oh, God!"
HB
This
Sampl
HO
THEA
NEW

REFERENCE SECTION

1)Numerous videotapes on 1/2 inch (Beta and VHS) format have been prepared by Bob Cooper to assist you in learning more about the satellite system and industry. See separate listing of these tapes here.

2)People interested in learning more about reception from the international (Intelsat) series satellites are advised to write: Mr. Steve Birkill, Real-World Technology, 128 Cross House Raod, Sheffield, S30 3RX, England.

3)If you are interested in procuring a commercially constructed and installed terminal on a turnkey basis that includes the necessary FCC licensing and program rights package, contact:

a)Mr. Richard Campbell, HOMESAT, Inc. 3845 Pleasantdale Rd., Atlanta, 30340 (404-449-2000)

b)Mr. Cliff Gardiner, Gardiner Communications Corp., 2000 S. Post Oak Rd., Suite 1490, Houston, Texas 77056 (713-961-7348)

4)If you are interested in discussing a possible 'program rights permission package', we suggest you contact: Mr. Ed Taylor, Southern Satelite Systems, P. O. Box 45684, Tulsa, OK 74145 (918-664-4812

5)If your proposed terminal will serve **50 or more homes**, and therefore qualify as a 'cable TV distribution system', for a run down on what that involves for you under FCC Cable Television Rules, we suggest you contact: Mr. Richard L. Brown, Brown & Bernstein, 1521 O Street NW, Washington, D.C. 20005 (202-387-3100)

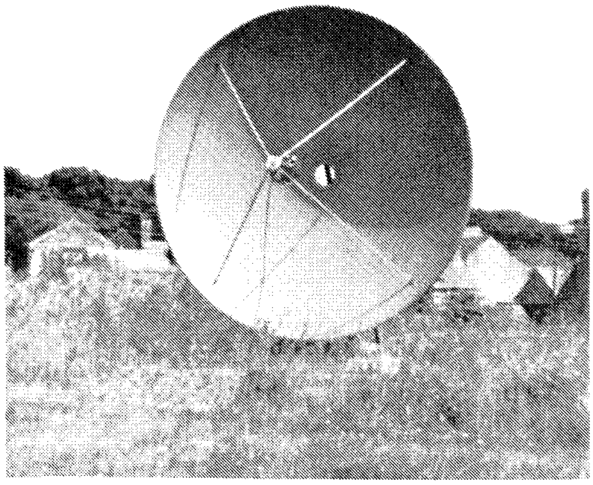
6)If you are have difficulty locating a source for MATV/CATV parts, including cable, connectors, amplifiers and the like, we suggest you contact: DAVCO, P. O. Box 861, Batesville, Arkansas 72501 (501-793-3816

7)**CATJ Magazine** - From May of 1974 through June of 1979, CATJ Magazine was edited by Bob Cooper. During the 1976-77-78-79 period, this magazine printed more material concerning the development of the satellite TV industry than all other sources combined. Unfortunately, back issues of CATJ are **not** available. What is available are Xerox copies of articles that have appeared. We suggest that the **best** material, of interest to **private** terminal enthusiasts, includes the following (when ordering, specify article name and issue of CATJ and include 15 cents per page you wish copied):

1)**Small Terminal Engineering Guide** - September 1977, 12 pages
2)**Passives For TVRO's At 4 GHz** - December 1977, 6 pages
3)**Private TVRO Terminals** - April 1978, 12 pages
4)**LNA Technology That Affects You** - April 1978, 15 pages
5)**Satellite Dominates** - August 1978, 6 pages
6)**Audio and Data On The Birds** - August 1978, 7 pages
7)**Satellites / Update '78** - September 1978, 25 pages
8)**Satellites / Update Part 2** - October 1978, 15 pages
9)**S. J. Birkill/Experimental Terminals** - October 1978, 4 pages
10)**Finding Intelsat** - November 1978, 8 pages
11)**S. J. Birkill/Experimental TErminals** - November 1978, 4 pages
12)**The Sick Bird Routine** - December 1978, 13 pages
13)**S. J. Birkill/Experimental Terminals** - December 1978, 4 pages
14)**S. J. Birkill/Experimental Terminals** - January 1979, 7 pages
15**Feed Rotation System** - February 1979, 8 pages
16)**S. J. Birkill/Experimental Terminals** - February 1979, 4 pages
17)**Canada's Illegal TV Network** - March 1979, 9 pages
18)**The Super Station Battle** - March 1979, 9 pages
19)**S. J. Birkill/Experimental Terminals** - March 1979, 3 pages
20)**Special MDS Report** - April 1979, 26 pages
21)[illegible]
22)**[illegible] Satellites** - May 1979, 6 pages
23)**RCA/AFRTS Demonstrate Two For One** - May 1979, 4 pages
24)**S. J. Birkill/Experimental Terminals** - May 1979, 4 pages
25)**Low Cost Terminal Plans** - June 1979, June 1979, 9 pages
26)**S. J. Birkill/Experimental Terminals** - July 1979, 5 pages

To order these Xerox copies of articles from CATJ, write: CATJ Librarian, Suite 106, 4209 NW 23rd, Oklahoma City, OK 73107 and enclose proper payment with order.

Note: For the first half of 1979 this **'Satellite Study Packet'** included as a part of the packet a copy of a recent issue of CATJ Magazine. However, under the new editorialship arrangements at CATJ the devotion to the satellite TV area has been changed and current issues of CATJ are primarily devoted to cable television 'terrestrial' news and activities. **We can no longer recommend CATJ** as a source for current material in this field and therefore no longer include a copy of CATJ with Study Packets ordered from Satellite Television Technology.



BIRKILL'S EIGHT FOOT - TVRO antenna in Sheffield, England is used for reception from Russian, experimental and and Intelsat series satellites serving Europe, Africa, South America, North America and Asia. Talk about international reception!!!

TEN FOOT EXPERIMENTAL ANTENNA - mounted on a flat-bed truck for 'mobile testing' (although not while in motion!) has been used extensively throughout USA under Coop's guidance to 'plot' signal reception.

TEN FOOT DISH PICTURE - quality is excellent and there is no noise with ten foot dish and typical 120 degree K LNA.

8)**TVRO Antenna Suppliers -**
Antennas are available in several formats and the following list of suppliers are currently servicing this field.
a)**Antenna Kits -**
Kintech Technology, 1080 Ticonderoga Drive, Sunnyvale, CA 94087 (John Kinik); 12 and 16 foot all aluminum do-it-yourself kits.
PARAFRAME, P. O. Box 423, Monee, IL 60449 (Jim Vines); 12 foot and larger stressed parabolic kits plus antenna plan design manuals.
b)**Complete Antennas**
Andrew Corporation, 10500 W. 153rd St., Orland Park, IL 60462 (312-349-3300)
Anixter-Mark, 5439 W. Fargo Av., Skokie, IL 60076 (312-675-1500; Ed LaMarre)
Prodelin, Inc., 1350 Duane Av., Santa Clara, CA 95050 (408-244-4720)
USTC, P. O. Drawer 'S', Afton, OK 74331 (918-257-4257; Danny Weathers)
9)**TVRO Receiver Suppliers**
The following firms supply receivers as a primary part of their business.
Farinon Electric, 1691 Bayport Rd., San Carlos, CA 94070 (415-592-4120)
Microdyne Corp., Box 1527, Rockville, MD 20850 (301-762-8500)
Microcomm, 14908 Sandy Ln., San Jose, CA 95124 (H. Paul Shuch, offers modules to assemble TVRO receiver; modules pre-tested and aligned.)
Terracom, 9020 Balboa Av, San Diego, CA 92123 (714-278-4100)
Scientific Communications, Inc., 3425 Kingsley Rd., Garland, TX 75041 (214-271-3685, Tom Humpheries)
10)**LNA Units**
With the recent development of workable LNA units which someone with electronic experience can duplicate on his own, the choices offered in this area have expanded:
Avantek, Inc., 3175 Bowers Av., Santa Clara, CA 95051 (408-249-0700)
Dexcel, Inc., 2285C Martin Av., Sant Clara, CA 95050 (408-244-9833; Art Kawai)
Real-World Systems, 128 Cross House Rd., Grenoside, Sheffield, S30 3RX, England (Steve J. Birkill; kits and circuit boards)
Robert W. Coleman, RFD 2, Box 58A, Travelers Rest, S.C. 29690 (circuit boards)
Scientific Communications, Inc., 4325 Kingsley Rd., Garland, TX 75041 (214-271-3685; Tom Humpheries)
11)**Complete System Packages**
Some of the firms already listed offer complete system packages, for turnkey installation or hardware alone. The listing of firms offering such services includes:
Farinon Electric (see previous listing, receivers)
Gardiner Communications Corp. (see reference #3 listing)
Hughes Microwave Communication Products, 3060 W. Lomita Blvd., Torrance, CA 90505 (213-534-2146; Abe Sonnenschein)
Microdyne Corporation (see previous listing, receivers)
Microwave Associates, Inc., 63 Third Av., Burlington, MA 01803 (617-272-3000; J. Duke Brown)
RMS/Harris, Inc., P. O. Box 1277, Kilgore, TX 75662 (214-984-0555)
Scientific-Atlanta, Inc., 3845 Pleasantdale Rd., Atlanta, GA 30340 (404-449-2000)
USTC (see previous listing, antennas)
12)**Coaxial Cable, Fittings, Signal Dividers**
Andrew Corporation (cable, fittings; see listing under antennas)
Decibel Products, Inc., 3184 Quebec, Dallas, TX 75247 (cable, fittings; 214-631-0310)
Merrimac Industries, Inc., 41 Fairfield Pl., W. Caldwell, N.J. 07006 (signal dividers; 201-575-1300)
Prodelin, Inc.. (cable, fittings; see listing under antennas)
(CATV type) Modulators
Blonder Tongue Labs, Inc., One Jake Brown Rd., Old Bridge, N.J. 08857 (201-679-4000; model TVM 4930 modulator for high quality unit)
Jerrold Electronics, Inc., Hatboro, PA 19040 (215-674-4800; Commander Modulators)
Phasecom Corp., 13130 S. Yukon Av., Hawthorne, CA 90250 (213-973-4191; model 2100 modulators)
RCA Community Television Systems, 7355 Fulton Av., N. Hollywood, CA 91605 (213-764-2411; model CTM10 modulators)
Scientific Atlanta, Inc. (see listing under turnkey systems; model 6350 modulator)
14)**Federal Communications Commission**
1919 M Street NW, Washington, D.C.20554 (for current status of TVRO licensing by FCC, Bill Lombardi at 202-632-5930)
15)**Engineering Assistance** with a private installation
Tony Bickel (918-786-5349)
16)**RCA Americom**
Vernon Valley (N.J.) uplink station - Bob Bennett (201-827-9400)
Public Affairs Officer - Ralph Graff (201-885-4400)
17)**Western Union**
Vernon Valley (N.J.) uplink station - John Moravich (201-764-4021)
Director, Broadcast Services - George Milne (201-825-5306)
18)**Christian Broadcast Groups**
CBN - Scott Hesseck (1-800-446-8081)
STC - Pete Warren (915-533-2911)
PTL - Jack Hightower (704-365-1250)
19)**Satellite Program Suppliers**
Eastern Microwave, Inc. (WOR; 315-455-5955)
Fanfare Television (713-960-6334)
Home Theater Network (207-774-6334)
HBO - (212-JU6-1212)
Modern Cable Programs - (516-437-6300)
Nickelodeon (212-484-6707
SHOWTIME (212-575-5175
***Southern Satellite Systems* (WTCG, KTVU, SPN; 918-664-4812)**
***STAR CHANNEL* (212-484-6707)**
***United Video* (WGN; 918-749-8811)**
20)***Glossary of Satellite Articles in Print***
TV GUIDE, *October 21, 1979 (U.S.)*
QST (March 12979, July 1979; 'New Frontier')
RADIO ELECTRONICS (six part series began August 1979)
73 (two part series, begins August or September 1979)
VIDEO (fall of 1979)
POPULAR SCIENCE (December 1979; tentative)
MOTHER EARTH NEWS (scheduled four part series to begin fall 1979)
MONEY (June 1979)
High Times (July 1979)

HOME SATELLITE TERMINALS - INFORMATION CENTER

Anyone giving serious thought to assembling, building, constructing or buying a private satellite television earth terminal (TVRO) is well advised to carefully review as much printed and other explanatory material as possible before making a decision on how to do it, and what to do it wirh. **Thousands of dollars can be saved** by carefully considering all of the equipment and techniques available, and selecting both equipment and an approach which you are comfortable with. Bob Cooper is now devoting full time to the technology of low cost satellite terminals, locating people who have done innovative things, and running down better ways to get the job done. His efforts and the efforts of others come into focus in the following materials which are available through Satellite Television Technology.

Printed Materials:

1)**EIRP MAPS** - A set of 11 maps (two color) showing the dBw signal contours for operating American and Canadian satellites. Price is $10 per set. **Order directly from:** eirp maps, % CATJ Magazine, Suite 106, 4209 N.W. 23rd, Oklahoma City, OK 73107.

2)**SATELLITE WALL CHART** - A large 22 by 35 four color, two-sided wall chart on heavy glossy stock that shows the location of all geostationary satellites, explains how they function and what services are available via each. Excellent tool for learning how the satellite system functions and what it takes to 'play in the game'. Price is $10 per wallchart. Order from: Wall Chart, %Satellite Television Technology, P. O. Box 2476, Napa, CA 94558.

3)**HOWARD TERMINAL MANUAL** - Build a complete terminal (less antenna reflector surface) including LNA, feed antenna, the complete receiver **and** the TV channel modulator for approximately $1,000 using brand new parts! Taylor Howard has pioneered the art of building a complete terminal using commonly available parts and simplified circuits. If you have modest electronic skills, are not afraid to tackle a construction project that is carefully documented but still requiring some individualism on your part, this 'manual' may well be your key to assembling your own terminal! This is a 24 channel tuneable receiver, four stage LNA and all of the bits and pieces manual. **PLUS** Taylor Howard will agreed to "consult" with you for an extra charge (payable directly to Howard through the address given in the manual) of $25 should you have problems. Price is $30 per copy; a data sheet explaining more about this manual is available for a self addressed, stamped envelope.

4)**COLEMAN TD-2 CONVERSION MANUAL** - Robert Coleman of South Carolina has pioneered the technology of locating very inexpensive 'surplus' electronic equipment, making small modifications to the equipment, plugging it together and receiving high quality satellite TV reception. And he has constructed a complete ten foot antenna/terminal featuring a 24 channel tuneable receiver, using this technique, for under $500! The Coleman TD-2 Conversion Manual features the Western Electric TD-2 surplus microwave receiver 'head' as a mixer stage; these units are available on the surplus market for typically $25 or less. In the Coleman manual, you learn how to assemble a complete terminal using largely surplus equipment, plus, you learn how to build your own state-of-the-art GaAs-FET low noise amplifier (LNA). A circuit board layout is included. Order directly from Satellite Television Technology, P. O. Box 2476, Napa, California 94558. Price is $30 per copy; a data sheet explaining more about this manual is available for a self addressed stamped envelope.

5)**PACKAGE NUMBER ONE:** Order both the Howard Manual **and** the Coleman Manual **at the same time** and save $10! Special package price of $50 for both manuals if ordered together.

6)**SWAN SPHERICAL REFLECTOR MANUAL** -An innovative TVRO antenna developed by Oliver Swan of Arizona, utilizing a design found in large radio-astronomy dishes such as at Arecibo, Puerto Rico. This ten foot by ten foot reflector surface antenna uses common aluminum window screen for the reflector surface, common 'gas pipe' for the reflector support members. Antenna gain is equivalent to a 10 to 11 foot true parabolic but with much lower construction costs and east of construction. The unique design allows the user to leave the reflector surface stationary and move the feed along a line parallel to the surface to 'change satellites'. Includes instructions for special 'feed antenna' developed to work with spherical surface. Order directly from Satellite Television Technology, P. O. Box 2476, Napa, CA 94558. Price is $30 per copy; a data sheet explaining more about this manual is available for a stamped, self addressed envelope.

Videotape Materials:

All videotapes listed have been prepared by Bob Cooper and segments of many of these tapes have been utilized on his 'SATELLITE MAGAZINE' television program seen Thursdays at 12 noon (eastern) on SATCOM FI transponder 21. This is not a complete list of tapes available. To receive a complete, current list of tapes available, send a self addressed stamped envelope requesting 'TAPE TIME LIST' to: Tape Time, P. O. Box G, Arcadia, Oklahoma 73007.

1)**TAPE HTS1** - "How The Home Terminal Works", nearly two hours of informal, instructive material as Bob Cooper takes you on a mini-tour of his own private terminal, and shares with you some videotape highlights of some of the excitement of private terminal operations. Includes fascinating Hughes Aircraft 15 minute mini-program that explains how satellites are launched and operated. Price is $45 in VHS, $40 in Beta format, full color. Order HTS-1 from : Tape Time, P. O. Box G, Arcadia, Oklahoma 73007.

2)**TAPE HTS-2** - "Private Terminals Today", approximately one hour ten minutes includes interview - discussions between English experimenter Steve Birkill, Canadian private terminal pioneer Rod Wheeler and the developer of the first U. S. private terminal receiver Steve Richey. This tape is informative and useful, but because the interviews were conducted in the summer of 1978 it is rapidly becoming outdated. Price is $45 in VHS, $40 in Beta format, full color. Order HTS-2 from: Tape Time, P. O. Box G, Arcadia, Oklahoma 73007.

3)**TAPE HTS-3** - "TV Terminal Technical Topics", a fascinating tape with a wealth of difficult to find information for the technically minded private terminal enthusiast. The very best TVRO engineers from cable and broadcasting fields discuss everything about the TVRO; from field surveys to interference studies. Receiver designs (both 'low cost' and commercial), LNA design and operation, testing procedures for the TVRO terminal once installed and much more. Price is $45 in VHS, $40 in Beta format, full color. Order HTS-3 directly from: Tape Time, P. O. Box G, Arcadia, Oklahoma 73007.

4)**TAPE HTS-4** - "How The Bird Flies", takes you inside the famous RCA Vernon Valley, N.J. satellited television uplink site where approximately 1/2 of all of the popular satellite television originates. A tour of the terminal, shows how the birds are 'flown' by flight controllers, where the video originates and how, how the satellites operate and are commanded by computer control and much, much more. Includes a frank discussion of what the ailments of the RCA satellites are, how this might impact on future satellite service. Around two hours in length. Price is $45 in VHS, $40 in Beta format, full color. Order HTS-4 *directly* from: Tape Time, P. O. Box G, Arcadia, Oklahoma 73007.

ORDER FORM

PRINTED MATERIALS ORDER FORM

Order all of the following from: Satellite Television Technology, P. O. Box 2476, Napa, California 94558.

Qty.	Item		Price Each	Total Enclosed
________	SATELLITE WALL CHART	$10	$________	________
________	HOWARD TERMINAL MANUAL	$30	$________	________
________	COLEMAN TD-2 MANUAL	$30	$________	________
________	PACKAGE NUMBER ONE: Howard + Coleman Manuals	$50	$________	________
________	SWAN SPHERICAL ANTENNA MANUAL	$30	$________	________

(total enclosed $________________)

SHIP TO:

NAME ________________________________

Address ________________________________

Town/City ____________ State(Country) ____________ Zip ________

NOTE: Enclose full payment with order and make payment to: **Satellite Television Technology.**